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Classifying Solid Waste Disposal Facilities

Versar, Inc.
Springfield, VA

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EPA

Classifying Solid Waste Disposal Facilities

Guidance Manual

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The Guidance Manual for the Classification of Solid Waste Disposal Facilities assists States in evaluating existing solid waste disposal facilities. Evaluations are made to identify those facilities which do not comply with the "Criteria for Classification of Solid Waste Disposal Facilities and Practices" (the Criteria). As defined by the Resource Conservation and Recovery Act (RCRA) of 1976, facilities which do not comply with these Criteria are "open dumps".

Those facilities that are evaluated by the States and found not to comply with the Criteria will be reported to the Environmental Protection Agency and published in the Open Dump Inventory.

The Criteria provide minimum national standards for the protection of health and the environment from adverse effects resulting from solid waste disposal. The manual provides technical guidance on setting priorities for facility evaluations and on determining whether a particular facility violates the Criteria.

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CLASSIFYING SOLID WASTE DISPOSAL FACILITIES

A Guidance Manual

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EPA Office of Solid Waste contributors and reviewers included: John Skinner, Truett DeGeare, David O'Brien, and Arthur Day.

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The assistance of all the State solid waste programs is particularly appreciated. Each State supplied information on its current solid waste disposal regulations, procedures, and permit programs. In addition, 18 States also participated on the National Governors' Association task force to assist EPA in the development of the manual, under the chairmanship of Jack Carmichael of Texas. Further, solid waste staff from the States of Pennsylvania and Minnesota enabled and assisted Versar and EPA in preliminary testing of the draft manual procedures at eight disposal facilities.

Finally, the assistance afforded by the Association of State and Territorial Solid Waste Management officials, the National Solid Waste Management Association, Governmental Refuse Collection and Disposal Association, and the American Public Works Association in the development of the manual is greatly appreciated.

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INTRODUCTION

The purpose of this document is to assist States in evaluating existing solid waste disposal facilities in order to identify those facilities which do not comply with the "Criteria for Classification of Solid Waste Disposal Facilities and Practices" (the Criteria). The Criteria were promulgated on September 10, 1979, under the authority of Sections 4004 and 1008 of the Resource Conservation and Recovery Act (RCRA) of 1976 and Section 405(d) of the Clean Water Act. The Criteria were published in the Federal Register on September 13, 1979 (Vol. 44, No. 179, p. 53438).

As defined by RCRA, facilities which do not comply with the Criteria are "open dumps." Those facilities that are evaluated by the States and found not to comply with the Criteria will be reported to the Environmental Protection Agency and published in the Open Dump Inventory required by Section 4005 of RCRA.

This Guidance Manual for the Classification of Solid Waste Disposal Facilities is designed as a decision-maker's guide for those responsible for allocating resources and for managing facility evaluations for the Open Dump Inventory. It contains suggested procedures representing EPA's synthesis of the state-of-the-art for evaluating existing facilities against the Criteria. This manual may also be useful to disposal facility managers in examining their facilities.

This manual provides technical guidance on setting priorities for the Inventory and on determining whether a particular facility violates the Criteria. Because no Federal enforcement actions result from such a determination, the manual does not address legal or enforcement issues (e.g., chain of custody, site access, inspection procedures, due process). However, to the extent that the State may use the results of these evaluations in any subsequent State enforcement actions, the evaluation procedures employed should take into account State legal requirements.

The Criteria provide minimum national standards for the protection of health and the environment from adverse effects resulting from solid waste disposal. The use of this manual's procedures to evaluate existing disposal facilities should go far in providing for uniform and consistant judgments in the application of the Criteria. Every effort has been extended to make this document understandable, practical, complete, and technically accurate and to provide that results obtained are replicable. It must be emphasized, however, that the Criteria, not the Guidance Manual, are the determining factors for the classification of facilities. While the States are not bound to use the procedures found in this document to evaluate facilities, EPA expects the States to either use the Guidance Manual or equivalent procedures (i.e., ones which achieve the same results), for development of the Inventory.

The Subtitle D Program

The Subtitle D program of RCRA seeks to improve solid waste management in the United States through funding of grants to States to support the development and implementation of State solid waste management plans. Guidelines for the development of these plans were promulgated under Section 4002(b) of RCRA on July 31, 1979 (44 FR 45066). In accepting a Subtitle D grant, the State agrees to develop a State plan which defines a process to close or upgrade existing open dumps (i.e., those facilities found to be in violation of the Criteria) and to prohibit new open dumps. The State also agrees to work toward development of regulatory powers to implement the plan; i.e., to enforce the prohibition of new open dumps and the closure or upgrading of existing open dumps.

The annual State grant application (the "work program") is developed with public participation and includes a list of those facilities which the State intends to evaluate against the Criteria during the year. The Guidance Manual will aid in making determinations for those Criteria elements for which the State must gather information or further analyze existing information in order to determine whether the facilities should be listed in the Inventory. Clearly, the States will not be able to evaluate all disposal facilities in one year. The State plan, which is also subject to public participation and public hearing, will provide for a schedule for the evaluation of facilities. This schedule is based on:

(1) potential health and environmental impacts of facilities;
(2) availability of State regulatory and enforcement powers; and
(3) availability of resources.

The procedures in the Guidance Manual will help the States determine which of the priority facilities are most likely to cause potential health and environmental impacts (i.e., violate the Criteria) and require greater scrutiny. The manual will also aid in establishing priorities for subsequent years' work programs.

The Open Dump Inventory

Under Section 4005(b) of RCRA, EPA is required to "publish an inventory of all disposal facilities or sites in the United States which are open dumps within the meaning of this Act." An open dump is a disposal facility which does not comply with the Criteria.

Using this manual or equivalent procedures, the States will use Subtitle D grant funds to identify those facilities which violate the Criteria. EPA encourages the States to evaluate each facility for all of the Criteria elements, particularly where the facility is expected to be upgraded. However, EPA will publish as the "Open Dump Inventory" a list of all facilities which the States have found to fail any one or more of the Criteria.

It should be noted that a facility may only be listed in the Open Dump Inventory for violation of the Criteria, and not for violation of more stringent State or local standards. EPA recommends that the States inform all concerned parties (e.g., facility managers and users) of the classification of a facility as an open dump prior to EPA's publication of that facility in the Open Dump Inventory.

EPA will supply open dump inventory reporting forms to the States (see Appendix A). While the States may delegate facility evaluation work to sub-State agencies or private firms, or use field information gathered by a State, local or Federal agency (e.g., the NPDES permitting agency), the forms must be signed and submitted to EPA by a responsible State official. By October 1 of each year, the States are to submit a form to the Bureau of the Census for each disposal facility found to violate the Criteria during that fiscal year (October 1-September 30). The Bureau of the Census will process this data and EPA will publish annually in the Federal Register the list (Inventory) of those facilities identified by the

States as violating the Criteria. The Federal Register notice will explain that EPA is reporting on part of the State planning process and that the Inventory is a planning tool intended to provide information to the public and to help the States set priorities for their solid waste management programs. The listing of a particular facility does not constitute a legal determination subjecting any party to Federal sanctions under RCRA.

Coverage of the Manual

The procedures detailed in this manual are specifically designed for the evaluation of existing solid waste disposal facilities. While the Criteria, as explained in the September 13, 1979, Federal Register, apply to a broad range of disposal activities, the following assumptions and conditions regarding the use of the manual must be reviewed carefully prior to commencing evaluations:

(1) The manual is designed for the evaluation of currently operating solid waste disposal facilities. (For purposes of the Criteria, the term "disposal facility" is used to mean those facilities involved in the placement of solid waste on the land, and not such facilities as transfer stations, incinerators, resource recovery plants, etc.). Thus, the manual is not intended for use in evaluating permit applications for new facilities or for the design of such new facilities.

(2) With the exceptions listed in (3) below, the manual is designed to be used for evaluations of the following solid waste disposal facilities:

(a) municipal waste landfills;
(b) industrial waste landfills, both off-site and on-site.
(c) sludge and other waste landspreading facilities, including those accepting sludges or wastes from:

- sewage treatment plants,
- water supply treatment plants,
- air pollution control facilities,
- industrial or commercial facilities,
- mining and agricultural operations.

(d) surface impoundments of solid, liquid, or semi-solid waste;

(e) facilities for the disposal of septic tank pumpings.

(3) For purposes of the Inventory, the manual is not intended for use in the following cases:

(a) facilities where agricultural wastes (e.g., manure and crop residues) are returned to the soil as fertilizers or soil conditioners;

(b) facilities where overburden resulting from mining operations is deposited when the overburden is intended for return to the mine site;

(c) land application of:

- domestic sewage and
- treated wastewater from publicly-owned treatment works

(d) point source discharges of irrigation return flows or industrial discharges which are subject to permits under Section 402 of the Federal Water Pollution Control Act;

(e) source, special nuclear, or by-product material as defined by the Atomic Energy Act of 1954;

(f) location and operation of septic tanks;

(g) hazardous waste disposal facilities subject to regulation under Subtitle C of RCRA;

(h) underground well injection facilities subject to regulations for State Underground Injection Control Programs (proposed as 40 CFR Part 146); and

(i) backyard burning and composting of household waste by the homeowner.

(4) The State may evaluate an inactive facility and submit the results to EPA if the State believes the inactive facility may be causing adverse health or environmental effects, and if the State feels that it is important to upgrade such a facility. However, the State should be cautioned when using the manual for evaluating inactive facilities; the manual was designed specifically for operating facilities and the procedures may not be applicable to inactive facilities.

(5) Facilities on Federally-owned or leased land are subject to evaluation against the Criteria. States are encouraged to work with agencies responsible for Federal lands on plans for and conduct of the facility evaluations. Facilities on Federal lands are subject to Federal, State, and sub-State requirements for solid waste management (RCRA, Section 6001).

(6) Facilities on Indian lands may be classified if the State secures the approval of the tribe which has jurisdiction.

Guidance Manual Format

The manual addresses each Criteria element in a separate chapter. The chapters follow the organization and format listed below.

1. Criterion and Definitions

Each criterion is reproduced as presented in the Federal Register (44 FR 53438-53468, September 13, 1979).

2. Inventory Procedure

This section contains a summary of the suggested approach for evaluations for purposes of the Open Dump Inventory. Given the limited resources to develop the Open Dump Inventory, the evaluation approach presented in this manual consists of suggested schemes to eliminate facilities from further consideration, priority ranking schemes, and procedures to determine non-compliance.

For each Criterion, there are a number of questions to be answered in order to efficiently develop the Inventory, focus on priority facilities or groups of facilities, and identify violations of the Criterion. These questions are organized into a logical sequence which is depicted in a decision flow chart for each Criterion. The meanings of the flow chart terms are as follows:

(a) "Does not comply" means that the facility is an open dump for that reason.

(b) "Does not require further evaluation" means either that the evaluation has not shown the facility to fail the given Criterion, or that the Criterion is not relevant to the facility.

In either case (a) or (b) above, the evaluator should go on to the next box indicated in the flow chart or to another Criterion if there is no further box indicated. This procedure should be followed for all Criteria. If the flow charts and procedures contained in this manual have been followed from beginning to end, a facility will have been evaluated against the full Criteria, and all reasons (if any) for the facility to be classified as an open dump will have been identified.

3. Resolution of Decision Flow Chart Questions

Each question posed in the flow chart is restated in the text and step-by-step procedures, methods, and techniques for answering each question are presented.

As indicated previously, the procedures for evaluation of facilities involve:

(a) Elimination schemes

The first step in most evaluation procedures in this manual involves elimination of some facilities from further consideration. This elimination step is designed to omit from consideration or quickly rate those facilities to which the Criterion does not apply, and to show where non-compliance or the likelihood of non-compliance is easily determined.

(b) Ranking schemes

In order to optimize the use of limited resources for evaluating facilities and to focus attention on the facilities most likely to not comply with the Criteria (i.e., have a high probability of causing adverse effects), ranking schemes are presented. The emphasis on ranking schemes is greatest for those situations where the determinations are time consuming or expensive to make, and where the adverse effect involves risks to public health or safety.

(c) Determination schemes

Specific technical procedures are provided for identifying non-complying facilities. These procedures are for performance evaluations (i.e., measuring or predicting adverse effects) and/or substitute operational evaluations (i.e., evaluating the adequacy of techniques employed to control adverse effects).

For purposes of the Inventory and State planning activities, substitute operational evaluations are acceptable in lieu of performance evaluations where the state-of-the-art establishes a direct cause and effect relationship between adverse effect and operational technology (e.g., cover soil effectively controls rats).

4. Checklist

At the end of each chapter is a suggested decision checklist to be used for each disposal facility. The checklist summarizes the flow chart questions and provides a place indicating the determination for each specific facility.

Additional Issues

1. EPA believes that the current state-of-the-art precludes definitive determination of non-compliance with the Ground Water and Gas Criteria without monitoring.
2. EPA recommends that no disposal facility be classified as an open dump without an on-site field evaluation which reflects the current operation and physical conditions of the facility.
3. Field inspections should take into account how seasonal variations will affect data results. For example, rainy seasons impact surface leachate seeps; saturated or frozen surfaces increase methane migration and concentrations; vectors may appear seasonally; birds migrate; etc.
4. States must use their judgment in determining whether a problem observed on a single site visit constitutes non-compliance, taking into account the seriousness of the problem and any previous history of facility performance.
5. The manual is designed to be used by State managers, inspectors, and evaluators who have been sufficiently trained to apply the procedures. College degrees are not required, but a science background and/or solid waste management experience is preferred.

Revisions

This is the third printing of the manual, and it contains revisions to all chapters. Some changes are the result of field use of the first two editions. Format improvements and simple editorial changes have been made to all chapters. The Surface Water chapter has been modified to reflect substantive changes in the administration of Sections 402 and 404 of the Clean Water Act. The Ground Water chapter has been significantly expanded by the addition of guidance on ground-water sampling and data evaluation. Minor technical improvements have been made in the Floodplains and the Safety - Explosive Gases chapters. Parts of the Air and Safety - Fires chapters have been changed slightly. The suggested method for determining non-compliance with the Endangered Species Criterion has been simplified. The checklists at the end of each chapter have been revised to reflect these modifications.

The Criterion for the application of solid waste to land used for food-chain crop production (40 CFR §257.3-5) was promulgated as Interim Final on September 13, 1979. EPA plans to promulgate final rules for this activity by mid-1981. While the corresponding manual chapters have been revised, their scope remains based on the Interim Final Rules.

CHAPTER 1

AIR

1.0 Criterion and Definitions

§ 257.3-7 Air.

(a) The facility or practice shall not engage in open burning of residential, commercial, institutional or industrial solid waste. This requirement does not apply to infrequent burning of agricultural wastes in the field, silvicultural wastes for forest management purposes, land-clearing debris, diseased trees, debris from emergency clean-up operations, and ordnance.

(b) The facility or practice shall not violate applicable requirements developed under a State implementation plan approved or promulgated by the Administrator pursuant to Section 110 of the Clean Air Act.

(c) As used in this section "open burning" means the combustion of solid waste without (1) control of combustion air to maintain adequate temperature for efficient combustion, (2) containment of the combustion reaction in an enclosed device to provide sufficient residence time and mixing for complete combustion, and (3) control of the emission of the combustion products.

2.0 Inventory Procedure

For the purpose of the Inventory the approach is to initially eliminate from further consideration those disposal facilities at which open burning of solid waste does not occur. These facilities need not be evaluated further against the Air Criterion. Those facilities at which open burning does occur must then be evaluated for the type of waste burned and compliance with the State Implementation Plan (SIP) developed pursuant to the Clean Air Act. It is recommended that the evaluation of a facility against the Fire Criterion be accomplished together with evaluation against the Air Criterion.

For purposes of the Inventory, non-compliance with the Air Criterion provisions of §257.3-7(b), regarding State Implementaiton Plans, is directly related to any and all open burning requirements

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pursuant to the SIP. Violations of other SIP requirements (e.g., fugitive dust) are directly related to the implementation of the SIP and should be reported to the State agency responsible for the SIP. The manual does not contain provisions for evaluating a facility for other than the open burning requirements of a SIP.

The decision flow chart is presented in Figure 1-1.

3.0 Resolution of Decision Flow Chart Questions

3.1 Does open burning of solid waste occur at the facility?

The first step in evaluating a facility for the air criterion is to determine whether open burning occurs (flow chart question 1). [Note: Open burning occurs at facilities using trench or pit incinerators because such incinerators do not control emissions (see discussion of Air Criterion in preamble to 40 CFR Part 257.)]

In general, this criterion does not apply to surface impoundments and landspreading facilities since their operation does not normally involve open burning. There might, however, be special cases of combustible waste disposal and open burning at these types of facilities.

The procedure for determining whether open burning occurs at the facility is as follows:

(a) study the previous history of the facility through:
  - past inspection records
  - design plan and permit conditions (does facility have a variance which allows open burning?)
  - complaints of open burning
  - interview with local air quality agency

(b) conduct a field inspection
  - visual observation of active open burning (including evidence of underground fires)

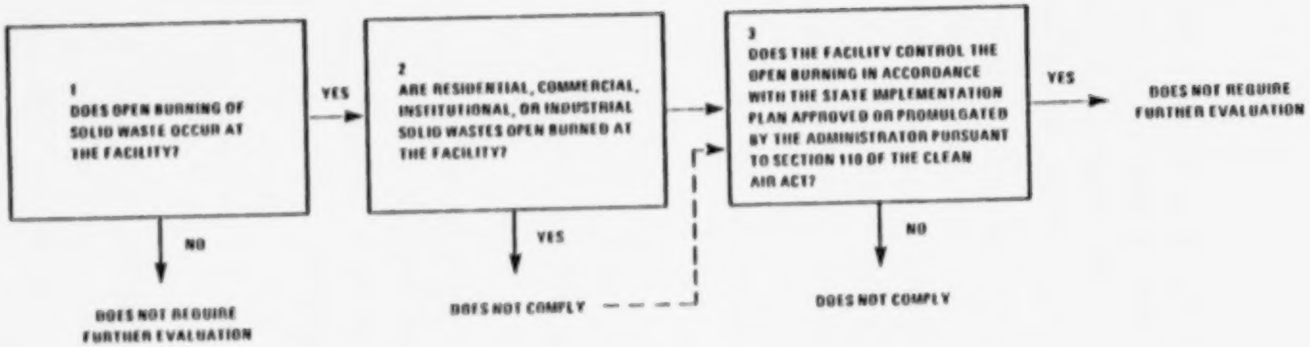
1
DOES OPEN BURNING OF SOLID WASTE OCCUR AT THE FACILITY?
YES
NO
DOES NOT REQUIRE FURTHER EVALUATION
2
ARE RESIDENTIAL, COMMERCIAL, INSTITUTIONAL, OR INDUSTRIAL SOLID WASTES OPEN BURNED AT THE FACILITY?
YES
DOES NOT COMPLY
3
DOES THE FACILITY CONTROL THE OPEN BURNING IN ACCORDANCE WITH THE STATE IMPLEMENTATION PLAN APPROVED OR PROMULGATED BY THE ADMINISTRATOR PURSUANT TO SECTION 110 OF THE CLEAN AIR ACT?
YES
DOES NOT REQUIRE FURTHER EVALUATION
NO
DOES NOT COMPLY

FIGURE 1-1 FLOW CHART – AIR

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- evidence of previous burning, such as
  - burning pits
  - ash piles
  - smoldering

The State evaluation of the information obtained as part of the Air Criterion investigation must balance the elements of previous history with the elements of field inspection to arrive at an accurate determination of "current" conditions at the facility.

For example, a facility may have a good history based on prior records, but may be burning or show evidence of burning at the time of inspection. Conversely, historical records may indicate frequent open burning at the facility while open burning may not be evident at the time of inspection. The determination of non-compliance must be specific to the facility being evaluated, be a reflection of "current" operation of that facility, and be made by the State using its judgment.

Where open burning does not occur, *the facility does not require further evaluation for the Air Criterion*. If open burning does occur, the next step is to determine the type(s) of waste being burned (flow chart question 2 as discussed in Section 3.2).

3.2 Are residential, commercial, institutional, or industrial solid wastes open burned at the facility?

Where past history and/or field inspection indicates that open burning does occur, it is necessary to determine if the wastes burned are residential, commercial, institutional, or industrial. If any of these prohibited wastes are open burned, then *the facility does not comply with the Air Criterion*.

If a facility is burning wastes which may not clearly fit the categories prohibited from open burning by this Criterion, the State must use its judgment in determining waste type because precise definitions of the categories are not possible.

The infrequent open burning of the following wastes is permissible:

- agricultural wastes in the field
- silvicultural wastes for forest management purposes
- land-clearing debris
- diseased trees
- debris from emergency cleanup operations
- ordnance

The State should be aware that some classes of ordnance, such as waste explosives and propellants, may be classified as hazardous wastes by the EPA hazardous waste management regulations (40 CFR Parts 260-266). As such, more stringent management and disposal criteria apply to them than required by this Criterion.

If only permissible wastes are infrequently open burned, it is then necessary to determine whether their open burning violates any applicable conditions of the State Implementation Plant (SIP). This evaluation process is presented in Section 3.3

3.3 Does the facility control the open burning of permissible wastes in accordance with the State Implementaiton Plan (SIP), approved or promulgated by the Administrator pursuant to Section 110 of the Clean Air Act?

The State or local agency responsible for assuring compliance with the State SIP should be consulted to determine whether the burning of the wastes violates the SIP (flow chart question 3). This agency should be given the information gathered as part of the evaluation and requested to identify violations of the applicable provisions of the SIP. To aid in supplying appropriate information to the responsible SIP agency, obtain from that agency the general and specific facility requirements of the SIP and regulations or guidelines developed thereunder for the open burning of the permissible wastes: field agricultural wastes, forest management silvicultural wastes, land-clearing debris, diseased trees, debris from emergency cleanup operations, or ordnance. The SIP may provide for conditional variances, permits, or exemptions for burning. These should be examined, recognizing, for example, possible limitations of open burning to certain:

- hours of the day
- seasons of the year
- atmospheric conditoins
- designated burn areas
- number of times per year
- distances from the working face, public roads, highways, residences, etc.
- notification requirements to the air agency, solid waste office, or fire department stating when open burning occurs
- times when adequate fire protection is available
- exemptions for certain areas of the State

If there are violations of the provisions of the SIP, *the facility does not comply with the Air Criterion*. The responsible State or local SIP agency should be asked to identify violations of the SIP. However, for purposes of the Inventory, it is ultimately the responsibility of the State agency conducting the Inventory evaluations to determine non-compliance.

CHAPTER 1

AIR

Criterion Compliance Decision

☐ *Does Not Require Further Evaluation*

☐ *Does Not Comply*

1. Does open burning of solid wastes occur at the facility?

☐ YES (continue to 2)

- ☐ Records of previous open burning
- ☐ Visual observation of open burning
- ☐ Physical evidence of previous open burning

☐ NO (*DOES NOT REQUIRE FURTHER EVALUATION*)

- ☐ Facility is a surface impoundment and does not open burn wastes
- ☐ Facility is a landspreading operation and does not open burn wastes
- ☐ Landfill which does not open burn

2. Are residential, commercial, institutional, or industrial solid wastes open burned at the facility?

☐ YES (*DOES NOT COMPLY* - continue to 3)

- ☐ Records of previous open burning
- ☐ Visual observation of open burning
- ☐ Physical evidence of previous open burning

☐ NO (continue to 3)

Wastes burned are of the permissible type:

- ☐ Agricultural wastes
- ☐ Silvicultural wastes
- ☐ Land-clearing debris
- ☐ Diseased trees
- ☐ Debris from emergency cleanup
- ☐ Ordnance

3. Does the facility control open burning of permissible wastes in accordance with the State Implementation Plan (SIP), approved or promulgated by the administrator pursuant to Section 110 of the Clean Air Act?

☐ YES (*DOES NOT REQUIRE FURTHER EVALUATION*)

- ☐ Variances, permits, or conditions under SIP examined
- ☐ Visual observations of open burning comply with SIP

☐ NO (*DOES NOT COMPLY*)

- ☐ Violations of SIP noted by State or local agency responsible for SIP
- ☐ Violations of SIP noted by State agency responsible for inventory evaluations

CHAPTER 2(a)

SAFETY - EXPLOSIVE GASES

1.0 Criterion and Definitions

> **§ 257.3-8 Safety.**
>
> (a) *Explosive gases.* The concentration of explosive gases generated by the facility or practice shall not exceed:
>
> (1) Twenty-five percent (25%) of the lower explosive limit for the gases in facility structures (excluding gas control or recovery system components); and
>
> (2) The lower explosive limit for the gases at the property boundary.
>
> **(e) As used in this section:**
>
> (3) "Explosive gas" means methane (CH_4).
>
> (4) "Facility structures" means any buildings and sheds or utility or drainage lines on the facility.
>
> (5) "Lower explosive limit" means the lowest percent by volume of a mixture of explosive gases which will propagate a flame in air at 25°C and atmospheric pressure.

2.0 Inventory Procedure

The classification process consists of:

(1) The elimination from further consideration of certain facilities at which methane is not generated; and those at which methane is prevented from migrating beyond the property boundary and accumulating in facility structures;

(2) Ranking of the remaining facilities based on the potential for any methane hazard at the time of the Inventory. This ranking step is suggested due to the large number of solid waste disposal facilities at which methane is likely to be generated, and the potential time involved for monitoring a facility. This procedure establishes an order for monitoring based on the potential for possible methane migration problems.

(3) Determination of non-compliance by monitoring for methane in facility structures and at the property boundary.

Figure 2(a)-1 presents the decision flow chart.

Other Definitions

As used in this chapter, for the purpose of the Inventory only:

The "property boundary" means the perimeter of the property on which a facility is sited; or the perimeter of the property, including buffer zones, which is designated as a facility by appropriate local and State regulations or permits; whichever is lesser.

3.0 Resolution of Decision Flow Chart Questions

3.1 Is methane generated?

Methane and carbon dioxide are the principal decomposition gases of organic wastes. Certain disposal facilities will either not generate any methane, or such minor amounts, that without monitoring they may be assumed not to require any further evaluation under this Criterion. The data needed to make this determination include:

(a) The type of waste, organic or inorganic, disposed of at the facility;

(b) The method of disposal, i.e., landfilling, surface impoundment, or landspreading;

(c) Operating conditions at surface impoundments.

This information can be collected from permit and inspection records, field observations, and interviews with facility owners or operators.

Those facilities for which no further evaluation is necessary for the purpose of the Inventory include:

(a) Landfills - Any landfills that have not in the past and do not presently accept organic waste, since no methane will be generated. Examples of wastes which are organic are coal and

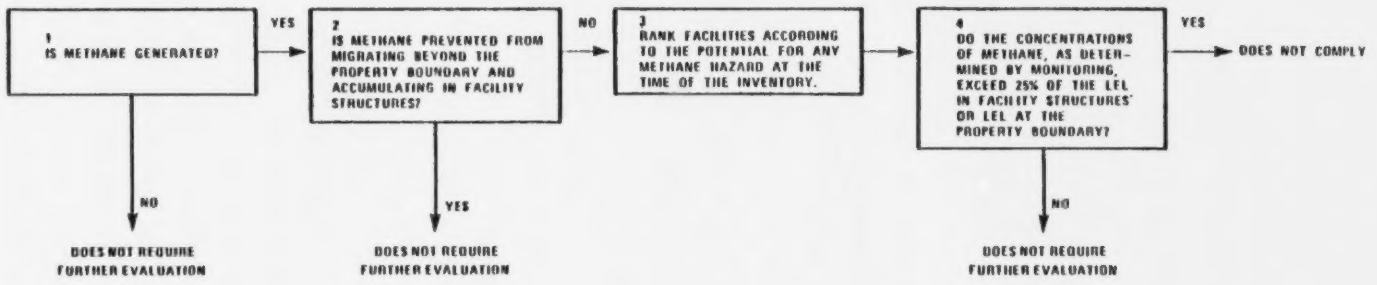

1
IS METHANE GENERATED?
YES
NO
DOES NOT REQUIRE FURTHER EVALUATION
2
IS METHANE PREVENTED FROM MIGRATING BEYOND THE PROPERTY BOUNDARY AND ACCUMULATING IN FACILITY STRUCTURES?
NO
YES
DOES NOT REQUIRE FURTHER EVALUATION
3
RANK FACILITIES ACCORDING TO THE POTENTIAL FOR ANY METHANE HAZARD AT THE TIME OF THE INVENTORY.
4
DO THE CONCENTRATIONS OF METHANE, AS DETERMINED BY MONITORING, EXCEED 25% OF THE LEL IN FACILITY STRUCTURES' OR LEL AT THE PROPERTY BOUNDARY?
YES
DOES NOT COMPLY
NO
DOES NOT REQUIRE FURTHER EVALUATION

FIGURE 2(a) 1 FLOW CHART-SAFETY-EXPLOSIVE GASES peat processing waste, incinerator, composting, resource recovery residues, septic tank pumpings, demolition material and wood waste, and general municipal solid waste.

(b) Landspreading Facilities - All landspreading facilities, since the waste is generally maintained in an aerobic condition, and methane production is an anaerobic process.

(c) Surface Impoundments - Where methane is generated within a surface impoundment, it is more likely that the gas will be expelled to the atmosphere across the free liquid surface than migrate through the impoundment walls. While it is possible that methane can be generated from leachate which has migrated from the facility, the State can assume that the methane migration potential from surface impoundments is generally low. Should the State encounter a surface impoundment where methane is generated, and where an enclosed facility structure is in contact with the liquid, an evaluation may need to be conducted.

3.2 Is methane prevented from migrating beyond the property boundary and accumulating in facility structures?

Methane migration and accumulation can be influenced by natural and artificial site-specific features. Migration can be impeded by frozen soil and slowed by saturated soil while migration would be expected to be more rapid in unsaturated soil than in ground water, methane is soluble in water (3.3 cubic centimeters will dissolve in 100 grams of water at 20°C). Unfractured rock will block movement. Gas venting or recovery systems can also control migration from the facility. Where the facility is completely surrounded (sides and bottom) by water, the gas may escape across the liquid surface, particularly if the surface water is flowing, rather than migrate far off site. It is also possible that methane can be generated from strong leachate which has migrated from the facility. Frozen soil is impermeable to methane movement, but it cannot be an effective natural control year-round (unless in permafrost areas). The presence of gas venting or recovery systems is not a prior evidence that methane does not migrate beyond these interception devices; the State should determine the effectiveness of these systems through monitoring.

Further evaluation need not be conducted for these facilities for which sufficient information is available to show that migration is prevented or is being controlled. Data needed to make this determination include:

- The location and types of facility structures;
- Hydrogeologic conditions surrounding the disposal area;
- Property boundaries;
- Information on any venting, migration control, or gas recovery systems; and
- Recent monitoring records from properly located monitoring points.

Examples of landfills which can be eliminated from further consideration are:

- Any landfill which is at all times entirely surrounded (sides and bottom) inside the property boundaries by water or saturated soil (e.g., surface water interconnected to ground water) or impervious rock and at which there are no facility structures located inside the surrounding barrier or on top of the waste deposit. This would be the case where a facility is in a marsh or swamp, a facility is on an island where the property boundary is at or outside the edge of the water, or where a high ground-water table is being lowered inside the facility property boundary by open drainage trenches. Facilities located in permafrost should also be included in this group.
- Any landfill with recent monitoring records which show that both sections of the Criterion are being met in accordance with the requirements of the monitoring section (3.4). (Conversely, if recent records show the levels stipulated by the Criterion are being exceeded in facility structures, or

at or beyond the property boundary, *the facility does not comply* and the evaluation may proceed to the next Criterion.)

3.3 Rank facilities according to the potential for any methane hazard at the time of the Inventory

The preceding sections have dealt with the elimination from further consideration of facilities which due to certain conditions meet both provisions of this Criterion. The only facilities remaining to be evaluated are landfills and perhaps a few surface impoundments. Due to the fact that very few landfill facilities are being monitored for gas, and the time involved in monitoring, a ranking technique is presented in this section, so that those facilities with the greatest potential methane hazard at the time of the Inventory can be given top priority for evaluation. The scheme separates facilities into high, medium, and low monitoring priorities based on a history of methane related events, field observation, and methane migration distance prediction charts. These priorities can be used to establish the order in which facilities are evaluated and the extent of the monitoring program.

3.3.1 Ranking Based on Methane Related Events

Facilities with the following characteristics should be given a high monitoring priority.

1. There is a history of methane related fires or explosions in facility or off-site structures, including non-pressurized utility lines;
2. Existing monitoring data at facility structures and off-site structures indicate that the requirements of the Criterion might be exceeded. This group should also include those facilities where migration control devices have been installed to control a historical problem in structures.

Further ranking procedures are presented in the remainder of Section 3.3, while the field evaluation procedures to determine non-compliance are presented in Section 3.4.

3.3.2 Ranking Based on Field Observations

Certain facilities can be assigned monitoring rankings from simple field observations. A scale plot plan of the facility and the surrounding land use within 1/4 mile of the facility, including the location of facility and off-site structures, is needed. The property boundaries and the existing solid waste limits should be on the map. A recent scale aerial photo might also be used. From this map, photo or plot plan, and an on-site inspection, the following rankings can be assigned:

(a) Low Priority - Those facilities at which there are no structures within 1,200 feet of any side of the existing solid waste limits.

(b) Medium Priority - Those facilities at which there are no structures within 300 feet of any side of the existing solid waste limits.

(c) High Priority - Those facilities having structres (on- or off-site) within 300 feet of the solid waste limits or at which there is evidence of unhealthy or dead vegetation outside or near any property boundary.

NOTE: Vegetation destruction is not necessarily related to the explosive gas hazard, but it may be a good indicator of the presence of high concentrations of methane gases.

For further evaluation of the facilities ranked on the basis of field observations, proceed to Section 3.4. For refining the ranking or establishing a priority for any remaining facilities that have not been eliminated or ranked, proceed to the third ranking step 3.3.3.

3.3.3 Ranking Based on Methane Migration Distance Prediction Charts

It may be helpful to further refine the priority by estimating the distance the methane may have migrated at the time of the Inventory. Migration distance charts have therefore been developed for Inventory ranking. These estimated distances, when compared to the location of the facility structures, property boundaries, and off-site structures, can then be used to further refine or change a monitoring priority and to plan the monitoring program.

The basic methane migration distance prediction chart and appropriate corrective factor charts were produced by imposing a set of simplifying assumptions on a general methane migration computer model. These charts should not be used for any purpose other than Inventory ranking because of the number of assumptions that had to be made to produce them.

To illustrate the use of the charts an example landfill is shown in Figure 2(a)-2 along with two cross-sections. Conditions along each side of the waste deposit are typical conditions that could be encountered. A similar sketch or plan of a facility being evaluated should be prepared. The land use within 1/4 mile of the solid waste limits, including off-site and facility structures, should be on the map. The property boundaries and solid waste deposit limits should also be plotted, as has been done in Figure 2(a)-2.

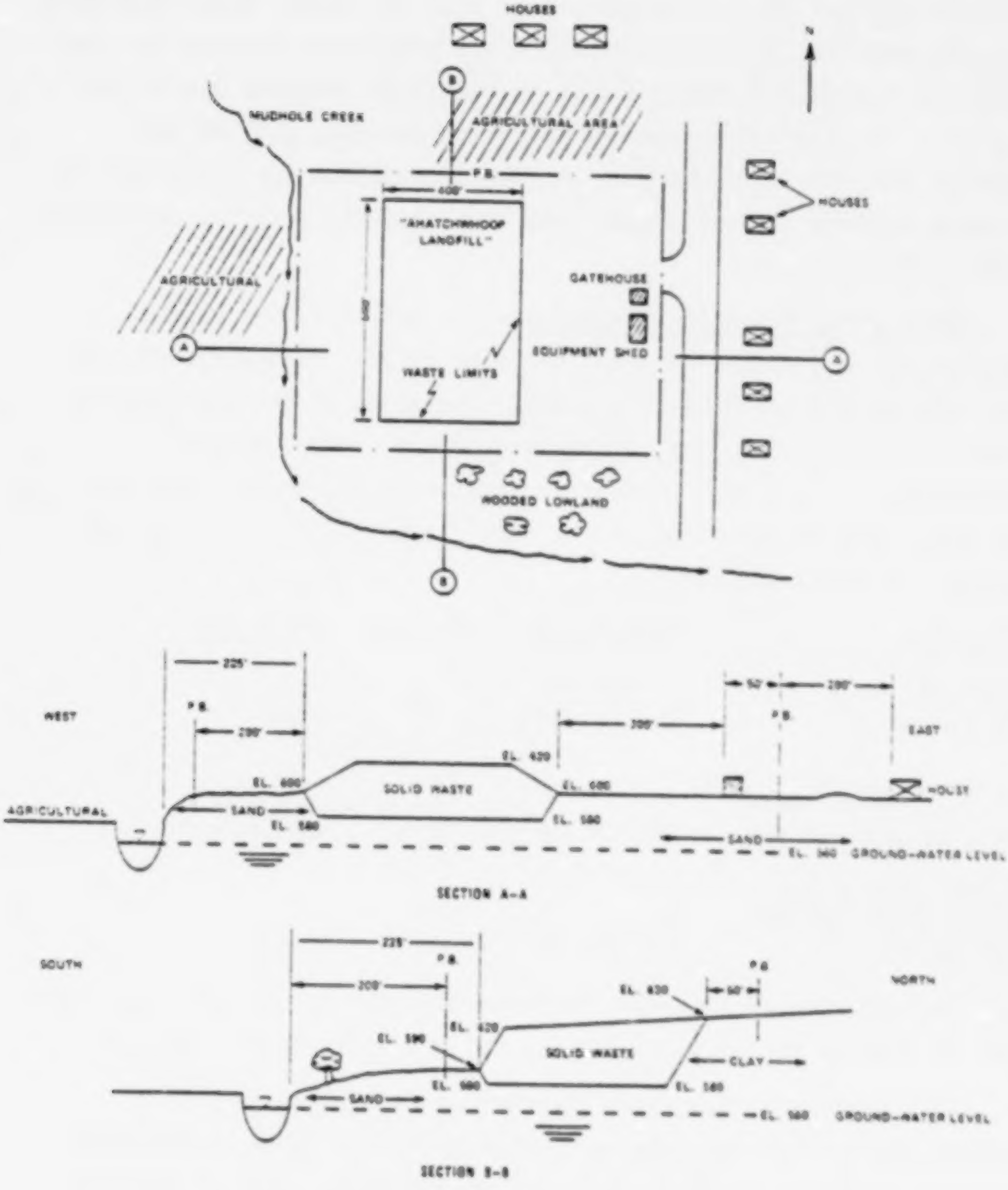
Additional data needs are:

1. The age of the site from the initial disposal of organic waste in years;
2. The average elevation of the bottom of the solid waste;
3. Natural boundaries and topography around the site;
4. The average elevation below the solid waste of a gas impervious boundary, such as unfractured rock.

Two calculations of migration distance from the waste boundary are needed for each side of the landfill:

1. The 5 percent (Lower Explosion Limit or LEL) distance for property boundaries.
2. The 1.25 percent (1/4 of the LEL) distance for on-site facility structures.

After preparation of the sketch and cross-sections, the determination of the estimated migration distances begins with the


HOUSES
N
MUDHOLE CREEK
AGRICULTURAL AREA
P.B.
400'
"AHATCHWHOOP LANDFILL"
600'
HOUSES
AGRICULTURAL
GATEHOUSE
EQUIPMENT SHED
WASTE LIMITS
A
A
B
B
WOODED LOWLAND
WEST
EAST
225'
P.B.
200'
EL. 620
200'
50'
200'
P.B.
EL. 600'
SOLID WASTE
EL. 600
HOUSE
AGRICULTURAL
SAND
EL. 580
EL. 580
SAND
EL. 560 GROUND-WATER LEVEL
SOUTH
NORTH
225'
P.B.
200'
P.B.
EL. 630
50'
EL. 590
EL. 620
SOLID WASTE
CLAY
SAND
EL. 580
EL. 580
EL. 560 GROUND-WATER LEVEL

SECTION A-A

SECTION B-B

FIGURE 2(a)-2 EXAMPLE LANDFILL (NOT TO SCALE) use of Figure 2(a)-3 for the 5 percent methane (LEL) migration distance and for the 1.25 percent (1/4 LEL) distance. These distances are then modified, if necessary, with the corrective factors for each depth and surrounding soil surface permeability [Figures 2(a)-4 and 2(a)-5]. The final distances of migration for each side of the landfill can then be plotted on the landfill sketch for comparison to property boundary and structure locations, and the priority determined using Table 2(a)-1.

Uncorrected Migration Distances - The use of Figure 2(a)-3 requires the age of the site and the type of soil extending out from each side of the solid waste deposit. The graph is entered with the site age, moving up to the appropriate soil type and methane concentration (1.25 or 5 percent). Interpolations between the sand and clay lines on the graph can be made for other soils, using the following general guidance:

Soil Name	USCS Classification	Chart Use
Clean (no fines) gravels and sands	GW, GP, SW, SP	Sand
Silty gravels and sands, silt, silty and sandy loam, organic silts	GM, SM, ML, OL, MH	Interpolate
Clayey gravels and sands, lean, fat and organic clays	GC, SC, CL, CH, OH	Clay

The uncorrected migration distance from the solid waste limit can then be read on the left for the appropriate site age and soil type.

If the soil along a given boundary is stratified and the variability extends from the waste deposit to the property boundary, the most permeable unsaturated thickness should be used in entering the charts. For example, if dry clean sand underlies surficial silty clays, the uncorrected migration distance should be obtained using the sand line of the chart. Where there are questions as to the extent of particular soils along a boundary, helpful information might be

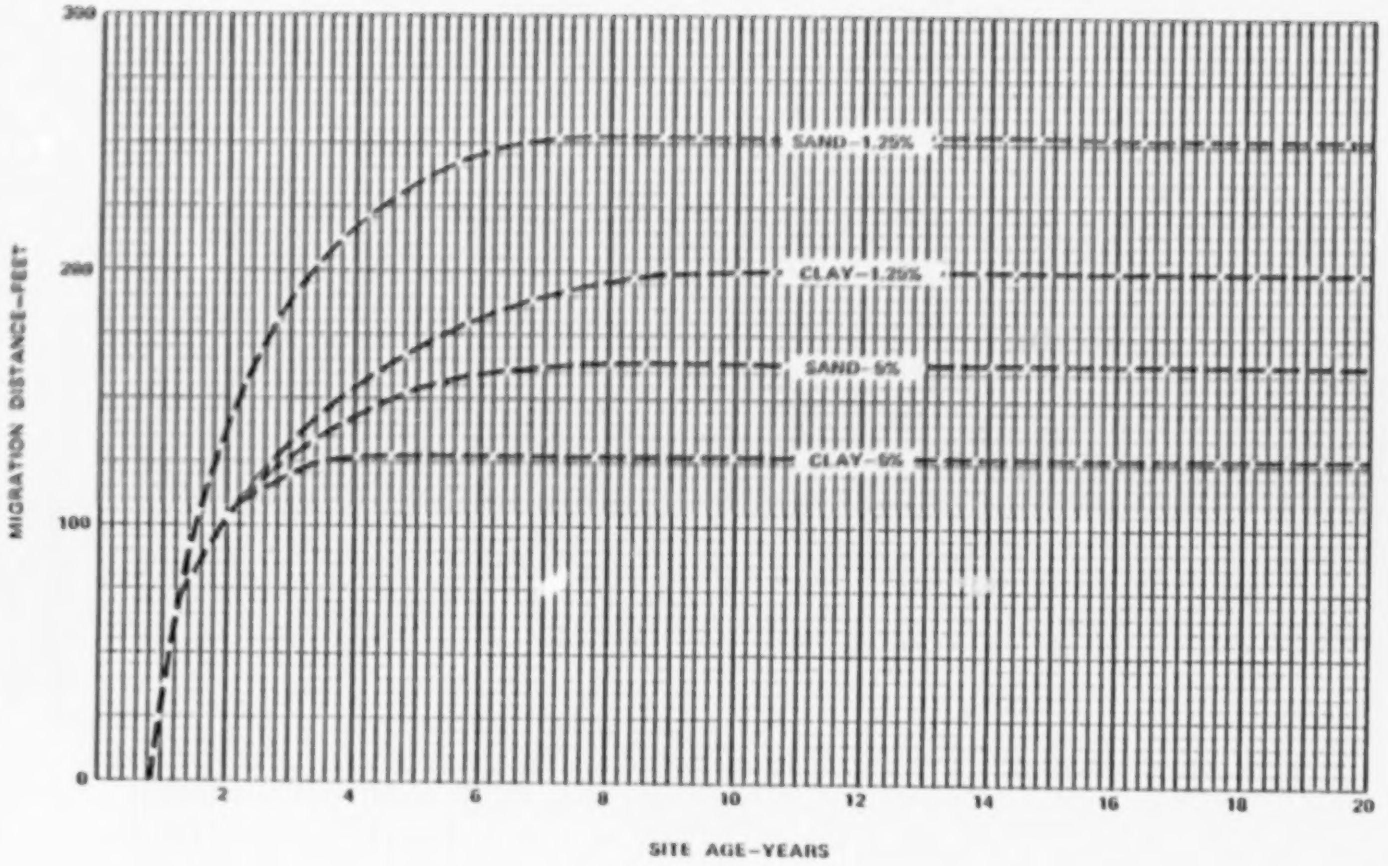


FIGURE 2(a) 3 5% AND 1.25% METHANE MIGRATION DISTANCE

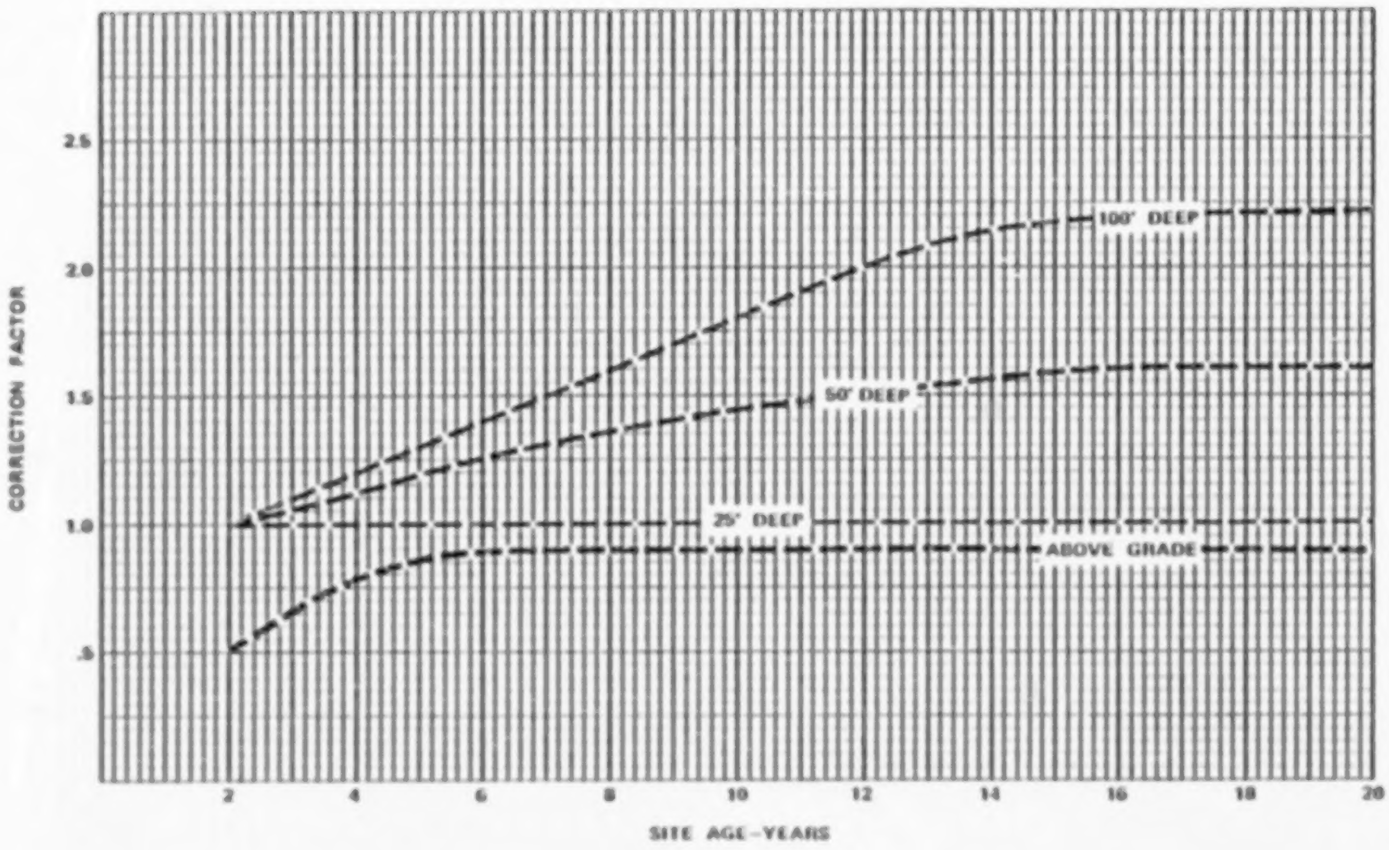


FIGURE 2(a)4 CORRECTION FACTORS FOR LANDFILL DEPTH BELOW GRADE

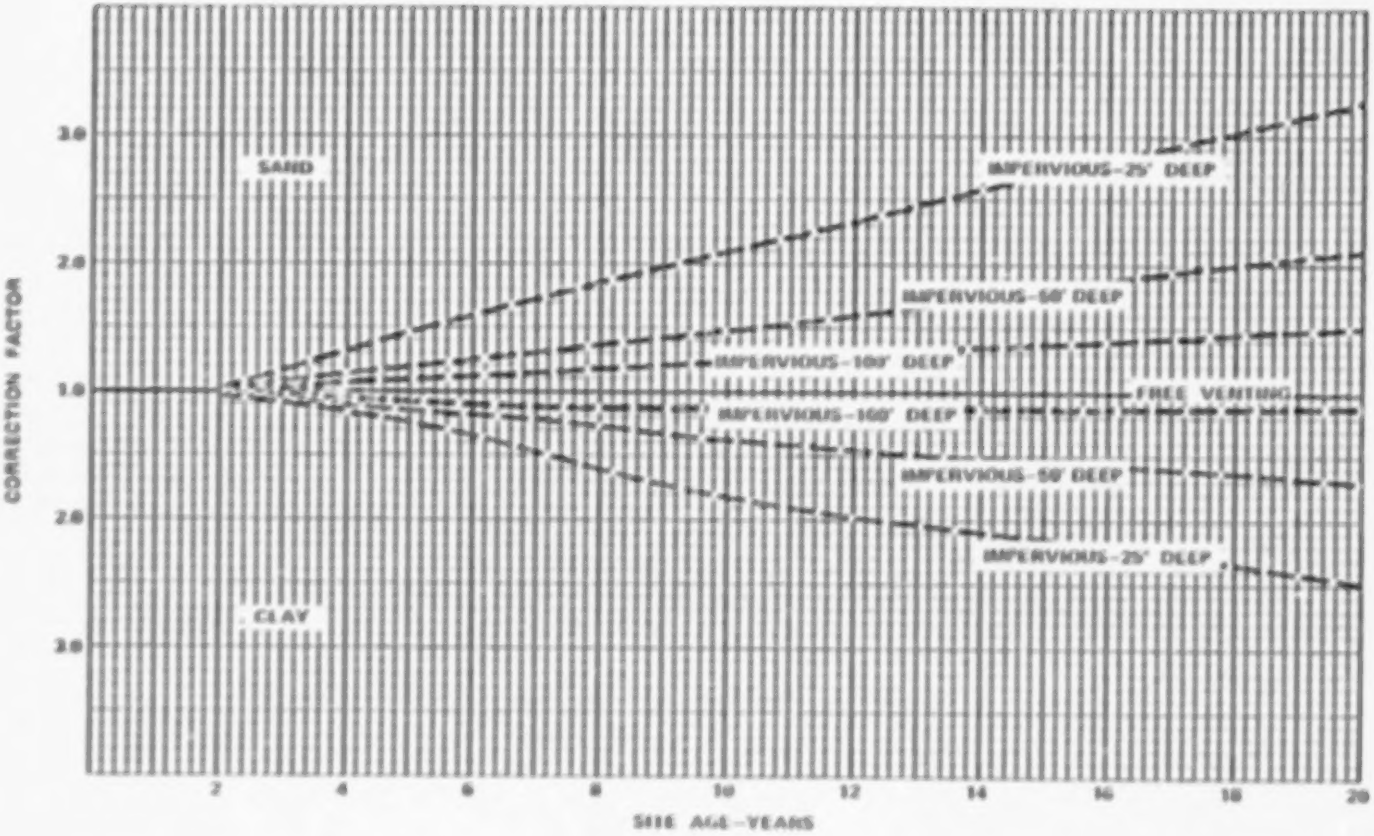


FIGURE 2LJ 5 CORRECTION FACTORS FOR SOIL SURFACE VENTING CONDITION AROUND LANDFILL

TABLE 2(a)-1

DISPOSAL FACILITY RANKING - METHANE GAS MIGRATION

	ESTIMATED METHANE CONCENTRATION AT APPROPRIATE DISTANCE				
Location of Structure of Concern	>5% Methane at a Structure	>5% Methane at the Property Boundary But Less than 1.25% at an Off-Site Structure	<5% Methane at the Property Boundary	<5% but >1.25% Methane at the Facility Structure	<1.25% Methane at the Facility Structure
Off-site	High	Medium	Low	--	--
On-site	High	--	--	Medium	Low

obtained from Soil Conservation Service Soil Survey Maps or the landfill operator. Field inspection, SCS maps and permit boring information are sufficient. Additional borings are not necessary as this is only a ranking procedure. Where there is doubt, use the most permeable soil group present.

For the example landfill in Figure 2(a)-2, the uncorrected 5 percent methane migration distances for a 10-year old landfill would be [Figure 2(a)-3]:

Section A-A: East side, 10 years, sand = 165'
West side, 10 years, sand = 165'

Section B-B: South side, 10 years, sand = 165'
North side, 10 years, clay = 130'

The corresponding uncorrected distances for the 1.25 percent methane migration would be:

Section A-A: East side, 10 years, sand = 255'
West side, 10 years, sand = 255'

Section B-B: South side, 10 years, sand = 255'
North side, 10 years, clay = 200'

The depth corrective multipliers for the example site would be:

Section A-A: East side, 10 years, 20' deep = 1.0
West side, 10 years, 20' deep = 1.0

Section B-B: South side, 10 years, 10' deep = 0.95
North side, 10 years, 50' deep = 1.4

Venting Conditions Correction - The corrective factors for the surrounding soil venting conditions are obtained using the chart in Figure 2(a)-5. This chart is based on the assumption that the surrounding surficial soil is impervious 100 percent of the time. Thus the value read from the chart must be adjusted, based on the percentage of time the surrounding surficial soil is saturated or frozen and the percentage of land along the path of gas migration from which gas venting to the atmosphere is blocked all year (asphalt or concrete roads or parking lots, shallow perched ground water, surface water bodies not interconnected to ground water). The totally impervious corrective factor is only used when the landfill is entirely surrounded at all times by these conditions. If both time and area adjustments are necessary, the percentages are additive. Estimates to the nearest 20 percent are sufficient. An adjusted corrective factor is obtained by entering the chart with site age and obtaining the totally impervious corrective factor for the appropriate depth and soil type and then entering this value in the following equation:

Adjusted corrective factor = [(Impervious corrective factor)-1]
x [% of impervious time or area] + 1

When free venting conditions are prevalent most of the year, simply use 1.0 (no correction). For depths less than 25' deep, use the 25' value. For the example site, the adjusted corrective factors for frozen or wet soil conditions 50 percent of the year are:

Section A-A: East side (ignore narrow road, sand, 20' deep, 10 years old) = (2.1-1)(.50)+1 = 1.55

West side (sand, 20' deep, 10 years old) = (2.1-1)(.50)+1 = 1.55

Section B-B: South side (sand, 10' deep, 10 years old = (2.1-1)(.50)+1 = 1.55

North side (clay, 50' deep, 10 years old) = (1.4-1)(.50)+1 = 1.2

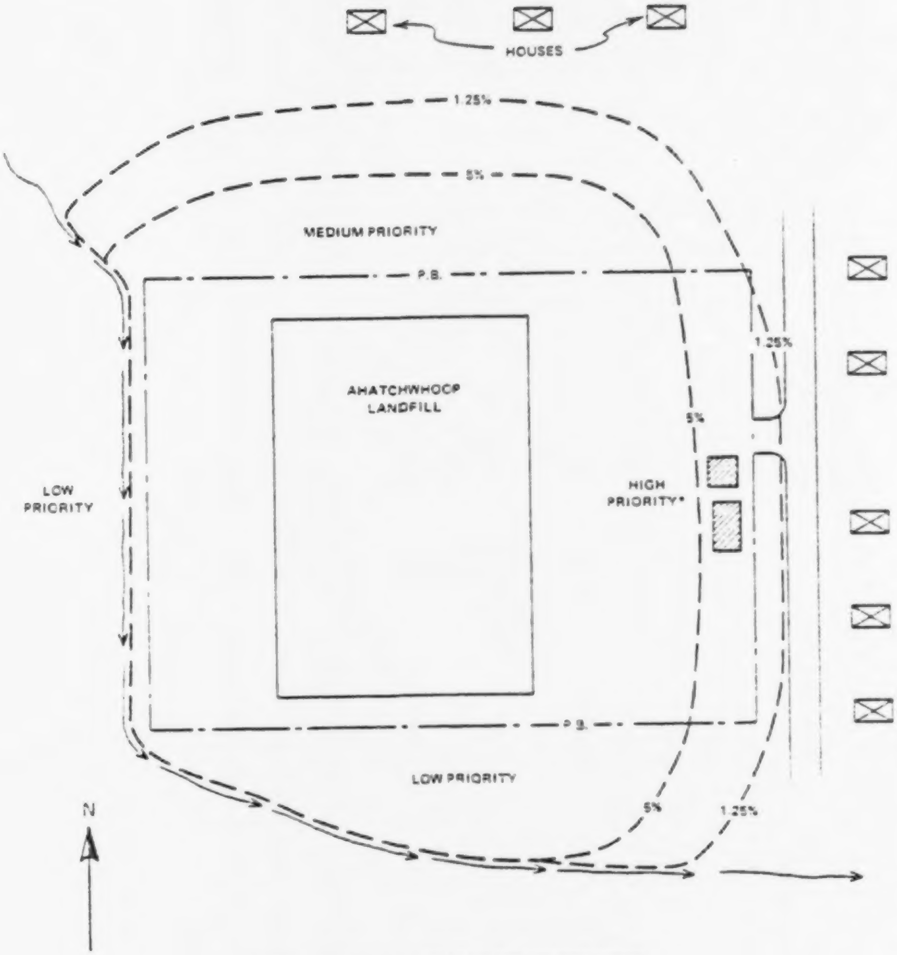
Once the surface venting factors have been tabulated in Table 2(a)-2, the corrected distance can be obtained by multiplying across the chart for each side of the landfill. These values can then be plotted on the scale plan to desribe contours of the five percent and 1.25 percent methane concentrations or simply compared to the distances from the waste deposit to structures of concern [Figure 2(a)-6]. The comparisons are then used with Table 2(a)-1 to arrive at a refined ranking or priority for facility monitoring.

TABLE 2(a)-2

METHANE MIGRATION DISTANCE TABULATING FORM

Landfill Side	Methane Concentration	Uncorrected Distance		Correction for Depth		Correction for Venting		Corrected Distance
E	5%	165'	X	1.0	X	1.55	=	256'
	1.25%	255'	X	1.0	X	1.55	=	395'
W	5%	165'	X	1.0	X	1.55	=	256' * (225' max.)
	1.25%	255'	X	1.0	X	1.55	=	395' * (225' max.)
S	5%	165'	X	0.95	X	1.55	=	243' * (225' max.)
	1.25%	255'	X	0.95	X	1.55	=	375' * (225' max.)
N	5%	130'	X	1.4	X	1.2	=	218'
	1.25%	200'	X	1.4	X	1.2	=	336'

* When these distances are plotted on the landfill sketch, they exceed the distance to the creek, which acts as a barrier to the gas migration. Thus the distance to the creek is the maximum migration distance.


HOUSES
1.25%
5%
MEDIUM PRIORITY
P.B.
1.25%
AHATCHWHOOP
LANDFILL
5%
LOW
PRIORITY
HIGH
PRIORITY*
P.B.
LOW PRIORITY
5%
1.25%
N

* HIGH PRIORITY RESULTS FROM STRUCTURES WITHIN
300' IN SAND, NOT FROM CONCENTRATION CONTOURS

FIGURE 2(a)-6 EXAMPLE LANDFILL METHANE CONTOURS

3.4 Do the concentrations of methane, as determined by monitoring, exceed 25 percent of the LEL in facility structures or LEL at the property boundary?

In order to determine non-compliance with the Criterion, it is necessary to monitor facilities for methane gas at facility structures and at the property boundaries. The ranking sequence helps provide the order of which landfills, and which boundaries or structures should be monitored first and the extent of the monitoring program.

The distance of methane movement and the concentration at a point at a particular time is quite dynamic, being influenced by a number of factors, including the stratification and moisture content of soils and the venting conditions at the soil surface surrounding the waste deposit. The location of probes and the timing of samples is very important in a monitoring program. Initial sampling locations and depths should be planned, based on a review of the facility soils information, structure locations, vegetative stress patterns, and the age of the waste. Sampling in a random fashion along the property boundary is not recommended.

For field measurements it is recommended that a combustible gas indicator be used to determine methane concentrations. Reported experience indictaes 0 to 100 percent LEL detection to be reasonably accurate with hot-wire catalytic combustion principal instruments. Inventory determinations only require readings of methane concentrations up to LEL (5 percent methane). This single scale is sufficient. Many users, however, prefer instruments with the capability of determining both the 0 to 100 percent LEL and the percent methane present when the concentration exceeds 100 percent LEL (5 percent methane). Dual scale instruments are available for this application. Typically, the 0 to 100 percent gas scale uses a thermal conductivity sensor. The carbon dioxide in landfill-generated gas is reported to interfere with the thermal conductivity sensor, so the readings above 100 percent LEL, while useful, cannot be assumed accurate. Some of the single scale 0 to 100 percent LEL instruments can also be fitted with air dilution tubes or valves to allow readings of the percent gas when the concentration is above the LEL. Instructions on the use and calibration of these instruments should be obtained from the manufacturer. Alternate instrumentation could include the collection of samples in vacuum bottles, with lab analysis using a gas partitioner or chromatograph.

3.4.1 Monitoring in Facility Structures

Monitoring in a facility structure (i.e., those structures within the facility's property line) should normally be done after the building has been closed overnight or for a weekend, and when the soil surface has been wet or frozen for several days. Sampling should be done in confined areas where gas may accumulate, such as basements, crawl spaces, near floor cracks, attics, around subsurface utility connections, and in untrapped drain lines. Gas recovery and gas control equipment need not be sampled. The results, location, date, and time for each sample should be recorded. If any of the readings are equal to or greater than 1/4 LEL, *then the facility does not comply*. It might be desirable to repeat the tests at a later date or under different climatic conditions to verify the readings, particularly if the readings were close to 1/4 LEL or the facility is considered high priority based on the structure location.

3.4.2 Monitoring at the Property Boundary

Monitoring should be conducted along the top priority property boundaries of the site first. There should be a minimum of two monitoring points along a boundary. More points should be established at high than low priority facilities. The exact location and depth of the monitoring points should take into account any gas permeable seams, such as dry sand or gravel, alignment with an off-site point of concern, proximity of the waste deposit, areas where there is dead or unhealthy vegetation that might be due to gas migration, and areas where underground construction might have created a natural path for gas flow (utility lines). Gas migration paths can also be traced by beginning at the edge of the waste deposit and sampling outwards.

In soils that are of uniform depth, probes or sampling points should be at lest three feet below the ground surface. Where dry sand, gravel, or more gas permeable soil strata might interconnect the waste deposit and the property boundary, multiple sampling points should be used, with the uppermost one three feet deep and additional ones in the permeable soil layers.

For shallow sampling points (3 feet), a bar punch may be used. These bar punches should be equipped with insulated handles. A rubber stopper around the probe line or gas impervious seal should be placed over the top of the hole during sampling to reduce outside air dilution. Readings may be taken immediately after making the barhole. If results are erratic, or in the one to five percent concentration range, the hole should be plugged and further readings taken a few minutes later. A deeper sampling point might also be used if measurements are in the one to five percent range in the three-foot hole. Example photos are shown in Figure 2(a)-7. Shallow permanent sampling points may also be excavated with a hand auger and be constructed with the various probes shown in Figures 2(a)-7 through 2(a)-11.

Multiple probe installations may be placed in the same hole, or in separate holes in the same location. Normally a boring rig or portable power auger will be needed to excavate for the installation of the deeper probes. Deep probes should not be sampled immediately after installation. Sewer and storm drain lines leaving the site or alongside it should also be monitored, alongside the line and in the line through manholes. Sewer gas interference can be checked by taking readings at several manholes and establishing the CH_4 level due to the sewer gas. Coal mines, natural gas storage, peat deposits, and leaky gas lines can also interfere with readings.

When sampling with a combustible gas indicator, samples should be withdrawn slowly with the vacuum pump or hand bulb until a high or constant reading is obtained. Frequently in small diameter holes in tight soils, a spike reading will be obtained initially and the

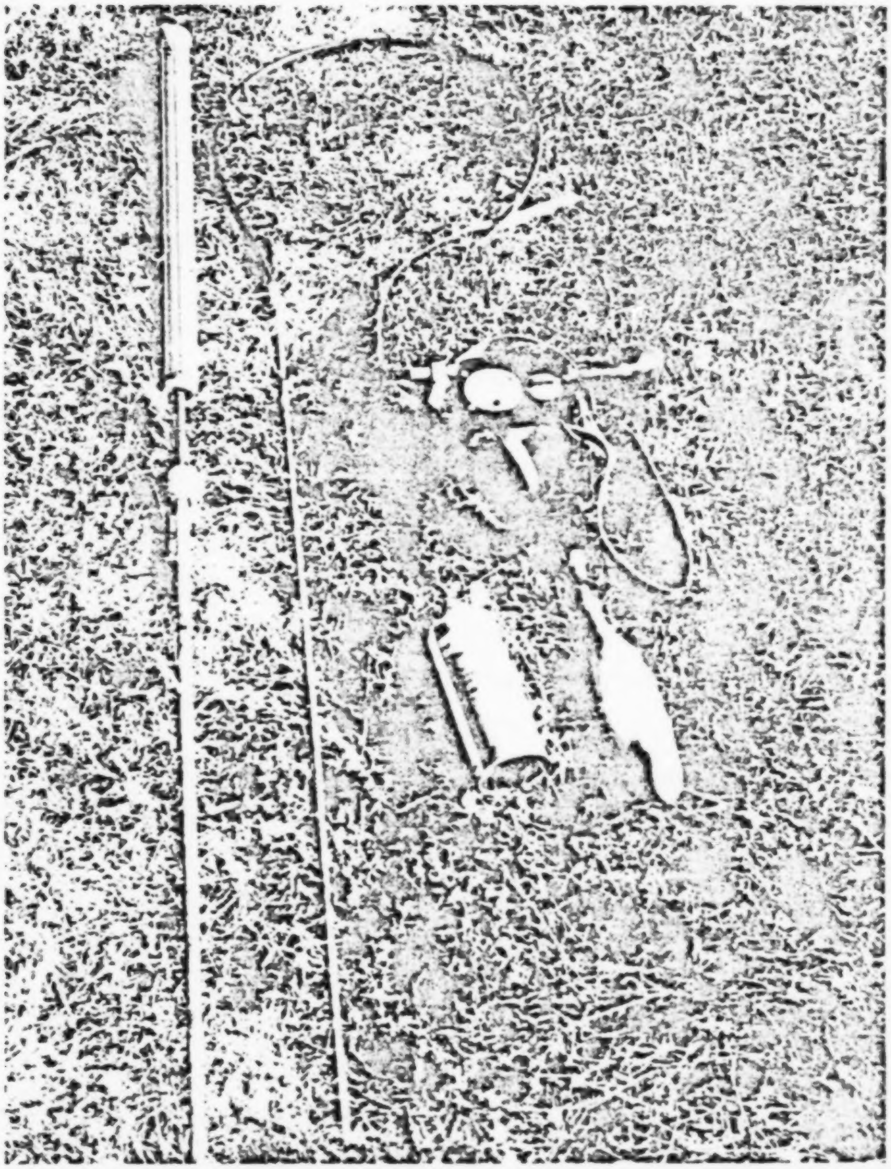
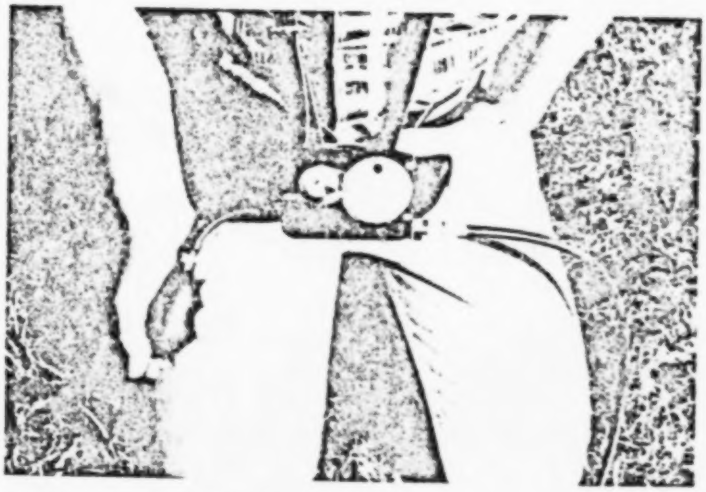


FIGURE 2(a)-7 FIELD APPARATUS/BAR HOLE PUNCH, EXPLOSIMETER, CALIBRATION KIT.

Reproduced from best available copy.

BAR HOLE PUNCH MAKER USED FOR MAKING GROUND GAS SAMPLING HOLES

WITHDRAWING GAS SAMPLE THROUGH AN EXPLOSIMETER



CLOSE-UP OF EXPLOSIMETER

FIGURE 2(a)-8 EXAMPLE OF GAS MONITORING APPARATUS

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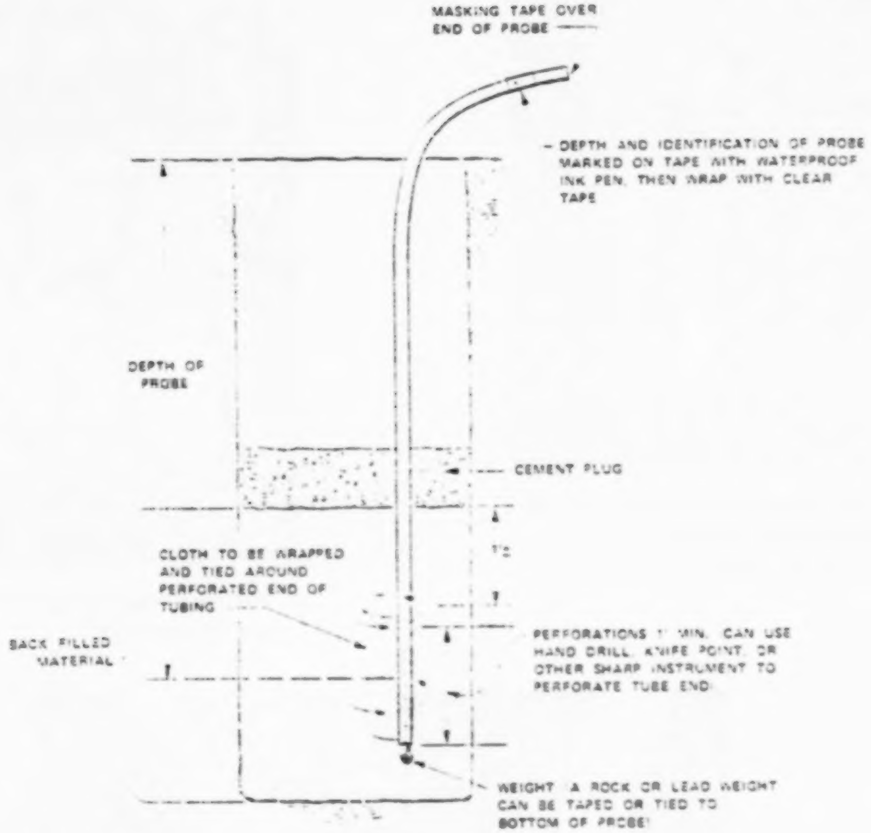
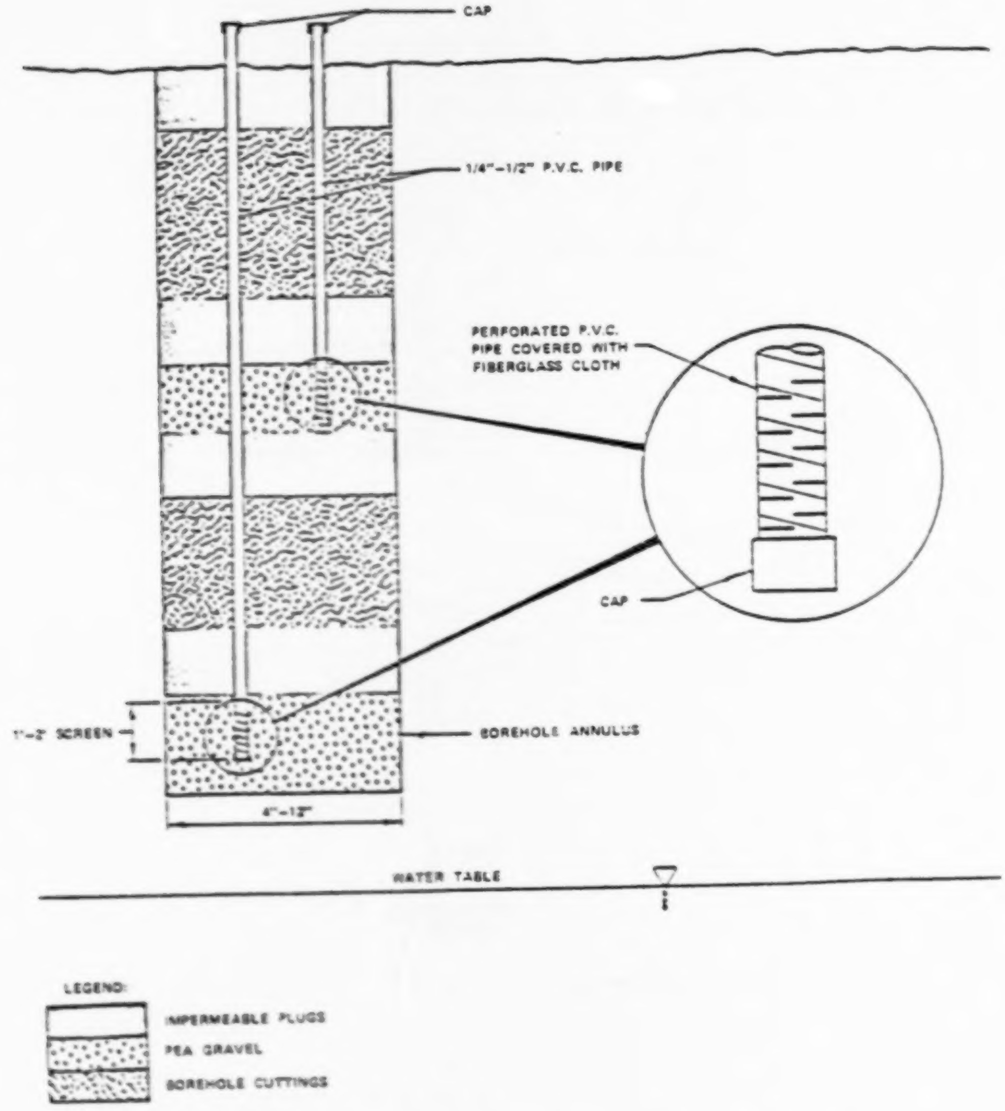

MASKING TAPE OVER END OF PROBE
DEPTH AND IDENTIFICATION OF PROBE MARKED ON TAPE WITH WATERPROOF INK PEN, THEN WRAP WITH CLEAR TAPE
DEPTH OF PROBE
CEMENT PLUG
1'0
CLOTH TO BE WRAPPED AND TIED AROUND PERFORATED END OF TUBING
BACK FILLED MATERIAL
PERFORATIONS (1' MIN.) CAN USE HAND DRILL, KNIFE POINT, OR OTHER SHARP INSTRUMENT TO PERFORATE TUBE END)
WEIGHT (A ROCK OR LEAD WEIGHT CAN BE TAPED OR TIED TO BOTTOM OF PROBE)

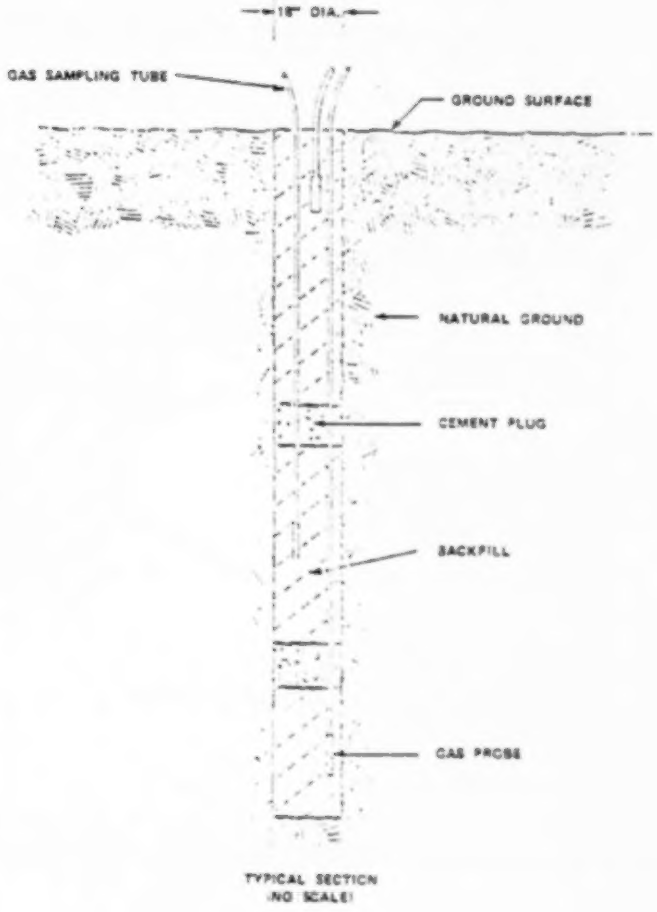
SOURCE: SCS ENGINEERS

FIGURE 2(a)-9 SCHEMATIC OF A TYPICAL GAS PROBE PLACEMENT


CAP
1/4"–1/2" P.V.C. PIPE
PERFORATED P.V.C. PIPE COVERED WITH FIBERGLASS CLOTH
CAP
1'–2' SCREEN
BOREHOLE ANNULUS
4"–12"
WATER TABLE
LEGEND:
IMPERMEABLE PLUGS
PEA GRAVEL
BOREHOLE CUTTINGS

SOURCE: ENVIRONMENT CANADA

FIGURE 2(a)-10 MULTI-LEVEL PERMANENT GAS PROBE INSTALLATION


18" DIA.
GAS SAMPLING TUBE
GROUND SURFACE
NATURAL GROUND
CEMENT PLUG
BACKFILL
GAS PROBE
TYPICAL SECTION
(NO SCALE)

SOURCE: SCS ENGINEERS

FIGURE 2(a)-11 TYPICAL MULTI-LEVEL GAS SAMPLING PROBE INSTALLATION concentration will then drop to low value. This is caused by exhausting the gas in the hole. The spike reading should be recorded as the actual concentration and checked by allowing the gas to return for a few minutes and taking another reading. When vacuum bottles are being used, at least the volume of air or gas in the probe and line should be withdrawn before taking a sample. The location or probe number, the time and date, and the results should be recorded.

If the site has a gas control or recovery system in operation, the sampling points should be located at the property boundary on the side of any gas system trenches or pipes farthest from the disposal area. It may be advisable to locate the sampling points off the facility within a distance of one-half the venting well spacing if the control system is located close to the property boundary. Multiple depth probes might be needed to check for leakage under the control system.

Sampling should preferably be done when the soil surface has been wet or frozen for several days. The results, location, date, and time should be recorded. If any of the readings are equal to or greater than five percent (LEL), *then the facility does not comply*. It might be desirable to repeat the tests at a later date or under different climatic conditions to verify the readings. Where pumping control systems are being used, samples should be taken when all pumps have been shut down for their maximum time during normal operation.

4.0 References

1. "Development of Construction and Use Criteria for Sanitary Landfills." County of Los Angeles and Engineering-Science, Inc., DHEW, PHS, BSWM, Cincinnati, Ohio, 1969.

2. "Landfill Decomposition Gases, An Annotated Bibliography." SW-72-1-01, SWRL, ORM, NERC, Cincinnati, Ohio, June 1972.

3. Flowers, F. B., et al. "Vegetation Kills in Landfill Environs," in "Management of Gas and Leachate in Landfills." EPA-600/9-77-026, September 1977.

4. Flowers, F.B. "Case History of Landfill Gas Movement Through Soils," in "Management of Gas and Leachate in Landfills." EPA-600/9-76-004, March 1976, pp. 177-189.

5. Moore, Charles A. "Theoretical Approach to Gas Movement Through Soils," in "Management of Gas and Leachate from Landfills." EPA-600/9-76-004, March 1976, pp. 33-43.

6. Moore, Charles A. and I. S. Rai. "Design Criteria for Gas Migration Control Devices," in "Management of Gas and Leachate in Landfills." EPA-600/9-77-026, September 1977, pp. 88-94.

CHAPTER 2(a)

SAFETY - EXPLOSIVE GASES

Criterion Compliance Decision

☐ *Does Not Require Further Evaluation*

☐ *Does Not Comply*

1. Is methane generated?

☐ YES (continue to 2)

- ☐ Landfill with organic waste
- ☐ Surface impoundment with a facility structure in contact with the liquid (special case)

☐ NO (*DOES NOT REQUIRE FURTHER EVALUATION*)

- ☐ Landfill with no organic waste
- ☐ Surface impoundment with no likelihood of methane migration
- ☐ Landspreading operations

2. Is methane prevented from migrating beyond the property boundary and accumulating in facility structures?

☐ YES (*DOES NOT REQUIRE FURTHER EVALUATION*)

- ☐ Landfill entirely surrounded within the property boundaries by permafrost, flowing surface water, or impervious rock and with no facility structures located inside the surrounding barrier or on top of the waste deposit
- ☐ Facility with gas venting or recovery systems and recent monitoring records showing no migration or accumulation

☐ NO (continue to 3)

3. Rank facilities according to the potential for any methane hazard at the time of the Inventory.

☐ High priority (continue to 4)

- ☐ History of methane-related fires or explosions
- ☐ Monitoring results that indicate a migration problem
- ☐ Facility or off-site structures within 300 feet of waste deposit
- ☐ Vegetative stress
- ☐ Ranking from Table 2(a)-1

☐ Medium priority (continue to 4)

- ☐ No facility or off-site structures within 300 feet of waste deposit
- ☐ Ranking from Table 2(a)-1

SAFETY - EXPLOSIVE GASES

(continued)

☐ Low priority (continue to 4)

    ☐ No structures within 1,200 feet of the waste deposit
    ☐ Ranking from Table 2(a)-1

4. Do the concentrations of methane, as determined by monitoring, exceed 25 percent of the LEL in facility structures, or LEL at the property boundary?

☐ YES (*DOES NOT COMPLY*)

☐ NO (*DOES NOT REQUIRE FURTHER EVALUATION*)

CHAPTER 2(b)

SAFETY - FIRES

1.0 Criterion and Definitions

> (b) *Fires.* A facility or practice shall not pose a hazard to the safety of persons or property from fires. This may be accomplished through compliance with § 257.3-7 and through the periodic application of cover material or other techniques as appropriate.
>
> (e) As used in this section:
>
> (6) "Periodic application of cover material" means the application and compaction of soil or other suitable material over disposed solid waste at the end of each operating day or at such frequencies and in such a manner as to reduce the risk of fire and to impede disease vectors' access to the waste.

2.0 Inventory Procedure

The first step in the Inventory procedure is to eliminate from further consideration those facilities handling non-combustible wastes. The remaining facilities are then evaluated for:

- compliance with the Air Criterion
- periodic cover application
- adequate operating procedures to control fires should they occur

The Fires Criterion is not satisfied when a facility poses a hazard to the safety of persons or property from fires. The evaluation is predicated on the concept that periodic cover must be used in combination with other techniques in order for a facility to not pose a hazard to persons or property from fires. For purposes of the Inventory, periodic cover means using daily cover unless the nature of the waste received does not warrant such a frequency; e.g., non-organic industrial waste, rock and earth debris, etc. The State Solid Waste Agency must judge the adequacy of cover practices and other control techniques for each specific facility based upon the history of operations and field inspection.

The decision flow chart is shown in Figure 2(b)-1.

3.0 Resolution of Decision Flow Chart Questions

3.1 Does the facility have the potential for fire occurrence?

A facility which received only non-combustible waste, such as rock and earth, or processed wastes and non-combustible sludges, liquids, and aqueous solutions or a landspreading facility that incorporates the waste into the soil does not have the potential for a fire hazard and *does not require further evaluation*.

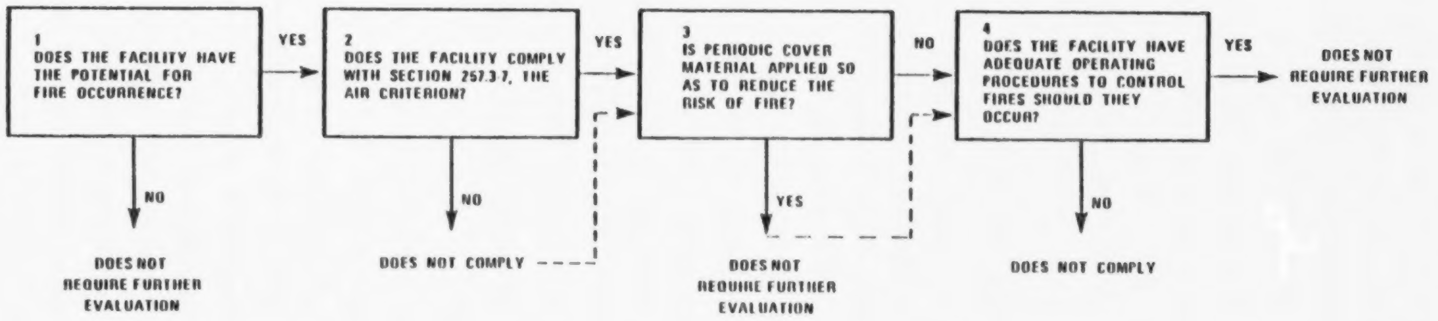
If a facility accepts combustible waste, continue to Section 3.2.

3.2 Does the facility comply with Section 257.3-7, the Air Criterion?

The preamble to the Criteria establishes clearly that open burning is a potential health hazard. Fires also can cause property damage and be a threat to public safety. Accordingly, the Fires Criterion mandates that facilities comply with the open burning requirements of the Air Criterion. Open burning is generally unsafe. A facility is allowed under the Air Criterion to open burn only limited wastes (agriculture wastes in the field, silvicultural wastes for forest management purposes, land-clearing debris, diseased trees, debris from emergency cleanup operations and ordnance.)

That Criterion also mandates that facilities not violate the applicable requirements developed under the State Implementation Plan (SIP) approved or promulgated by the Administrator pursuant to Section 110 of the Clean Air Act. The provisions of State Implementation Plans (SIPs) frequently address elements other than air pollution effects, such as:

- Efficiency of the burn
- Amount and type of waste
- Supervision of burning
- Limitation of access to burning areas


1
DOES THE FACILITY HAVE THE POTENTIAL FOR FIRE OCCURRENCE?
YES
NO
DOES NOT REQUIRE FURTHER EVALUATION
2
DOES THE FACILITY COMPLY WITH SECTION 257.3-7, THE AIR CRITERION?
YES
NO
DOES NOT COMPLY
3
IS PERIODIC COVER MATERIAL APPLIED SO AS TO REDUCE THE RISK OF FIRE?
NO
YES
DOES NOT REQUIRE FURTHER EVALUATION
4
DOES THE FACILITY HAVE ADEQUATE OPERATING PROCEDURES TO CONTROL FIRES SHOULD THEY OCCUR?
YES
DOES NOT REQUIRE FURTHER EVALUATION
NO
DOES NOT COMPLY

NOTE: DASHED LINE INDICATES THE NEED TO CONTINUE TO THE NEXT FLOWCHART QUESTION

FIGURE 2(b)1 FLOW CHART SAFETY-FIRES

1/81

- Secure arrangements with established fire agencies
- Extinguishing capabilities such as water, soil, and chemicals
- Burning equipment design and arrangements
- Interference with reasonable enjoyment of life and property
- Damage to vegetation or property

Thus, non-compliance with such provisions of a State's SIP at a particular facility can create a safety hazard to persons or property from the burning. Therefore, for purposes of the Inventory, non-compliance with Section 257.3-7 of the Criterion means the facility *does not comply with the Fires Criterion.*

3.3 Is periodic cover material applied?

For the purpose of the Inventory, the application and compaction of soil or other suitable materials at a facility over all combustible solid waste at the end of each operating day is sufficient to reduce the risk of fire and satisfy the requirements of the Criterion. A facility operated in this manner *does not require further evaluation.* For those landfill facilities operating 24 hours per day, it is sufficient to apply cover once each operating day. Those facilities which do not practice daily covering of all combustible waste or that open burn must next be evaluated for the adequacy of any other cover frequency and other fire control techniques (Section 3.4).

3.4 Does the facility have adequate operating procedures to control fires should they occur?

Facilities at which all combustible solid waste is not covered at the end of each operating day or where open burning occurs (even in compliance with the Air Criterion) must be evaluated to determine whether adequate operating techniques are employed to prevent and/or control fires, including underground fires. Evaluations are necessarily facility-specific and must include review of past records and field inspection. Local fire safety authorities should be consulted. Where facility operating procedures and fire control measures are inadequate so as to pose a hazard to persons or property, the facility *does not comply.*

(a) Where open burning occurs, the facility's fire control measures must be evaluated. Common control measures include:

- Supervision while burning is practiced
- Limitation of access to users while burning occurs
- Established arrangements with the local fire department
- Earth stockpiles near the burning area
- Arrangements for, or on-site availability of, heavy equipment to control spread of fire
- ater supply under sufficient pressure
- Fire extinguishers
- Presence of firebreaks or firelanes

(b) A landfill, where cover material is not applied to all combustible waste at the end of each operating day, must also be evaluated. The following factors should be considered in deciding whether there is a fire hazard.

- Previous inspections and reports.
- Permit conditions (for a fire protection plan).
- Complaint record.
- The adequacy of spreading and compacting of all combustible waste.
- Supervision of waste unloading to ensure that hot loads and special wastes that have a high potential for starting fires are unloaded a safe distance from the working face. (Also, supervision of the waste unloading area is required to prevent users from intentionally or accidentally setting waste on fire.)
- The practice of extinguishing hot or burning loads with soil or water before incorporating them into the fill.
- Presence of earth stockpiles located near the working face.
- Presence of a water supply under sufficient pressure available at the working face.
- Presence of fire extinguishers on all solid waste handling equipment.

- Established arrangements with the local fire-fighting department.
- Arrangements for availability of heavy equipment to extinguish fires.
- Presence of firebreaks or firelanes.

(c) Surface impoundments containing combustible wastes must be evaluated. The determination is again facility specific. The evaluation should include whether combustible wastes are properly handled or stored to prevent fires and the techniques that are employed to control fires. The following factors should be considered:

- Mixing of wastes to reduce flammability.
- Presence of suitable fire extinguishing equipment for the type of waste (water under pressure, foam, properly rated extinguishers.
- Arrangements with local fire department or trained on-site personnel.
- Ability to rapidly drain wastes and control inflow.
- Ability to isolate waste.
- Accessibility to the impoundment by fire-fighting equipment.

(d) The evaluation of landspreading facilities where combustible waste is being handled should consider the following factors:

- Availability of suitable fire extinguishing equipment for the type of waste (water under pressure, foam, or properly rated extinguishers).
- Arrangements with local fire department.
- Accessibility to the facility by fire-fighting equipment.

CHAPTER 2(b)

SAFETY - FIRES

Criterion Compliance Decision

☐ *Does Not Require Further Evaluation*

☐ *Does Not Comply*

1. Does the facility have the potential for fire occurrence?

   ☐ YES (continue to 2)

   ☐ NO (*DOES NOT REQUIRE FURTHER EVALUATION*)

   - ☐ Facility receives only non-flammable, non-combustible wastes

2. Does the facility comply with Section 257.3-7 of the Air Criterion?

   ☐ YES (continue to 3)

   ☐ NO (*DOES NOT COMPLY* - continue to 3)

3. Is periodic cover material applied so as to reduce the risk of fire?

   ☐ YES (continue to 4)

   - ☐ The facility applies and compacts cover over combustible solid waste at the end of the operating day
   - ☐ The facility applies and compacts cover at least once every 24 hours
   - ☐ The facility incorporates all waste into the soil at the end of the operating day

   ☐ NO (*DOES NOT COMPLY* - continue to 4)

4. Does the facility have adequate operating procedures to control fires should they occur?

   ☐ YES (*DOES NOT REQUIRE FURTHER EVALUATION*)

   - ☐ Landfill minimizes fire hazards when conducting open burning, such as:
     - ☐ Supervision during burning
     - ☐ Limiting access during burning
     - ☐ Established arrangements with the local fire department
     - ☐ Earth stockpiles near the burning area
     - ☐ On-site availability of heavy equipment to extinguish fires
     - ☐ Water supply under sufficient pressure is available
     - ☐ Fire extinguishers are available
     - ☐ Firebreaks or fire lanes are present

CHAPTER 2(b)

SAFETY - FIRES

(continued)

- ☐ Landfill not practicing open burning minimizes fire hazards by proper operating procedures:
  - ☐ Previous inspections and reports indicate no problem
  - ☐ Permit conditions are being followed (for a fire protection plan)
  - ☐ No complaints have been made
  - ☐ Records of local fire department indicate no citations have been given
  - ☐ High frequency of spreading and compacting all combustible wastes
  - ☐ Waste materials with high fire potential are unloaded a safe distance from the working face
  - ☐ Unloading of wastes adequately supervised
  - ☐ Hot or burning loads are extinguished with water or soil before incorporating into the fill
  - ☐ Earth stockpiles are located near the working face
  - ☐ Water supply under sufficient pressure is available at the working face
  - ☐ Fire extinguishers present on all equipment and buildings
  - ☐ Arrangements are established with local fire-fighting departments
  - ☐ On-site availability of heavy equipment to extinguish fires
  - ☐ Firebreaks, fire lanes are present
- ☐ Surface impoundment minimizes fire hazards by proper handling and storage of liquid wastes:
  - ☐ Wastes are mixed to reduce flammability
  - ☐ Suitable fire extinguishing equipment is present
  - ☐ Established arrangements with local fire department or trained on-site personnel
  - ☐ Wastes can be rapidly drained or waste flow can be controlled
  - ☐ Waste can be isolated
  - ☐ Impoundment is readily accessible by fire-fighting equipment
- ☐ Landspreading facility minimizes fire hazards by proper operating procedures:
  - ☐ Suitable fire-fighting equipment is available
  - ☐ Established arrangements with local fire department
  - ☐ Facility is readily accessible by fire-fighting equipment

CHAPTER 2(b)

SAFETY - FIRES

(continued)

☐ NO *(DOES NOT COMPLY)*

- ☐ Facility does not comply with any applicable safety or open burning provisions of the State Implementation Plan.

CHAPTER 2(c)

SAFETY - BIRD HAZARDS TO AIRCRAFT

1.0 Criterion and Definitions

(c) *Bird hazards to aircraft.* A facility or practice disposing of putrescible wastes that may attract birds and which occurs within 10,000 feet (3,048 meters) of any airport runway used by turbojet aircraft or within 5,000 feet (1,524 meters) of any airport runway used by only piston-type aircraft shall not pose a bird hazard to aircraft.

(e) As used in this section:

(1) "Airport" means public-use airport open to the public without prior permission and without restrictions within the physical capacities of available facilities.

(2) "Bird hazard" means an increase in the likelihood of bird/aircraft collisions that may cause damage to the aircraft or injury to its occupants.

(7) "Putrescible wastes" means solid waste which contains organic matter capable of being decomposed by microorganisms and of such a character and proportion as to be capable of attracting or providing food for birds.

2.0 Inventory Procedure

Solid waste disposal facilities have been found by study and observation to be artificial attractants of birds, often providing a feeding, watering, and roosting area. In the vicinity of airports, an increase in bird populations may increase the probability of a bird strike to aircraft. Thus, disposal facilities located in the vicinity of airports may contribute to a bird hazard to aircraft.

For the purpose of the Inventory, the facility classification process consists of:

(1) The elimination from further consideration of certain facilities based on their distance from airports.

(2) The elimination from further consideration of facilities handling only non-organic or non-putrescible wastes.

(3) Ranking of the remaining disposal facilities based on their potential to pose a bird hazard.

(4) The determination of whether a disposal facility poses a bird hazard to aircraft. Some facilities can be eliminated after a preliminary assessment, others will require detailed evaluations.

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The decision flow chart is presented in Figure 2(c)-1.

2.1 Further Definitions

As used in this chapter:

(a) "Piston-type aircraft" is an aircraft powered by reciprocating engine.

(b) "Turbojet aircraft" is an aircraft powered by a gas turbine engine.

(c) "Runway is a defined rectangular area, on a land airport, prepared for the landing and takeoff of aircraft along its length." (Federal Aviation Administration Glossary)

3.0 Resolution of Decision Flow Chart Questions

3.1 Is the disposal facility within the specified distances of a public-use airport?

Disposal facilities farther than 10,000 feet from any airport runway used by turbojet aircraft or 5,000 feet from any airport runway used only by piston-type aircraft *do not require further evaluation under this Criterion*. An example of this is shown in Figure 2(c)-2. Most of these determinations will be obvious. Where there are questions about classification of the airport, the type of aircraft using the runway, and the exact distance, the following procedures and definitions may be used.

Public-use airport, as defined in the criteria, means that anyone (the public) may use the airport without prior permission and without restrictions within the physical capacities of available facilities. This would include those airports that have restrictions based on safety or environmental considerations, such as:

- The number of planes per hour
- The hours of operation (noise or safety considerations)
- Types of planes; runways too short for turbojet planes

This does not include airports such as:

- Those restricted to specific individual or company planes

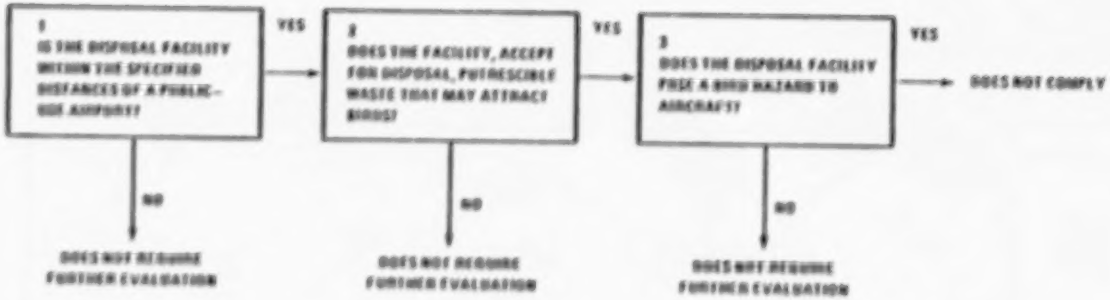

1
IS THE DISPOSAL FACILITY WITHIN THE SPECIFIED DISTANCES OF A PUBLIC-USE AIRPORT?
YES
2
DOES THE FACILITY, ACCEPT FOR DISPOSAL, PUTRESCIBLE WASTE THAT MAY ATTRACT BIRDS?
YES
3
DOES THE DISPOSAL FACILITY POSE A BIRD HAZARD TO AIRCRAFT?
YES
DOES NOT COMPLY
NO
DOES NOT REQUIRE FURTHER EVALUATION
NO
DOES NOT REQUIRE FURTHER EVALUATION
NO
DOES NOT REQUIRE FURTHER EVALUATION

FIGURE 2b11 FLOW CHART – SAFETY – BIRD HAZARDS TO AIRCRAFT

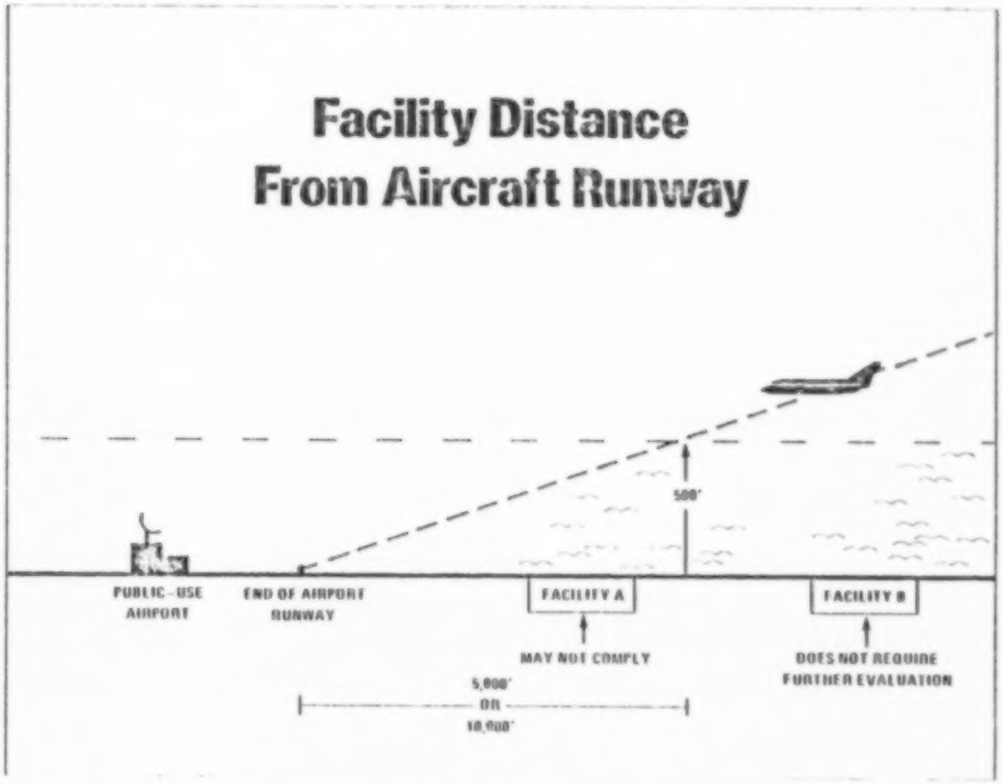

Facility Distance
From Aircraft Runway
500'
PUBLIC-USE AIRPORT
END OF AIRPORT RUNWAY
FACILITY A
MAY NOT COMPLY
FACILITY B
DOES NOT REQUIRE FURTHER EVALUATION
5,000' OR 10,000'

FIGURE 2(c) 2 FACILITY DISTANCE FROM AIRCRAFT RUNWAY

- Private individual's airstrips (not open to the public)
- Military airports

Up-to-date listings of public-use airports are contained in the appropriate volume of the Airport/Facility Directory published by the U.S. Department of Commerce, NOAA, National Ocean Survey, Rockville, Maryland 20852. The geographical areas for which the directory is published are shown in Figure 2(c)-3. The State Aviation Office might also have charts, maps, or lists of public-use airports.

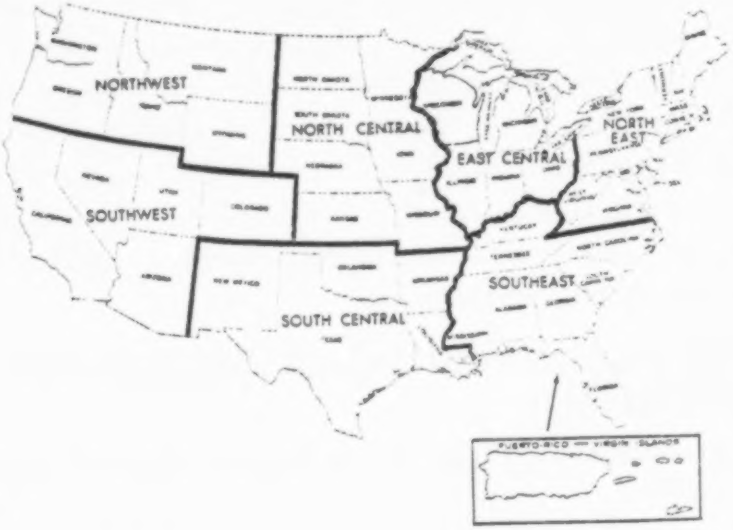

NORTHWEST
NORTH CENTRAL
EAST CENTRAL
NORTH EAST
SOUTHWEST
SOUTHEAST
SOUTH CENTRAL
PUERTO RICO — VIRGIN ISLANDS

Figure 2(c)-3. Geographical areas for NCAA airport/facility directory

Where there are questions about the type of aircraft using the runway, the airport owner or operation should be contacted. If turbojet aircraft use the runway in non-emergency situations, the 10,000-foot distance would apply. These situations would include, but not be limited to:

- Scheduled or non-scheduled commercial passenger or freight service
- Private traffic
- Military aircraft

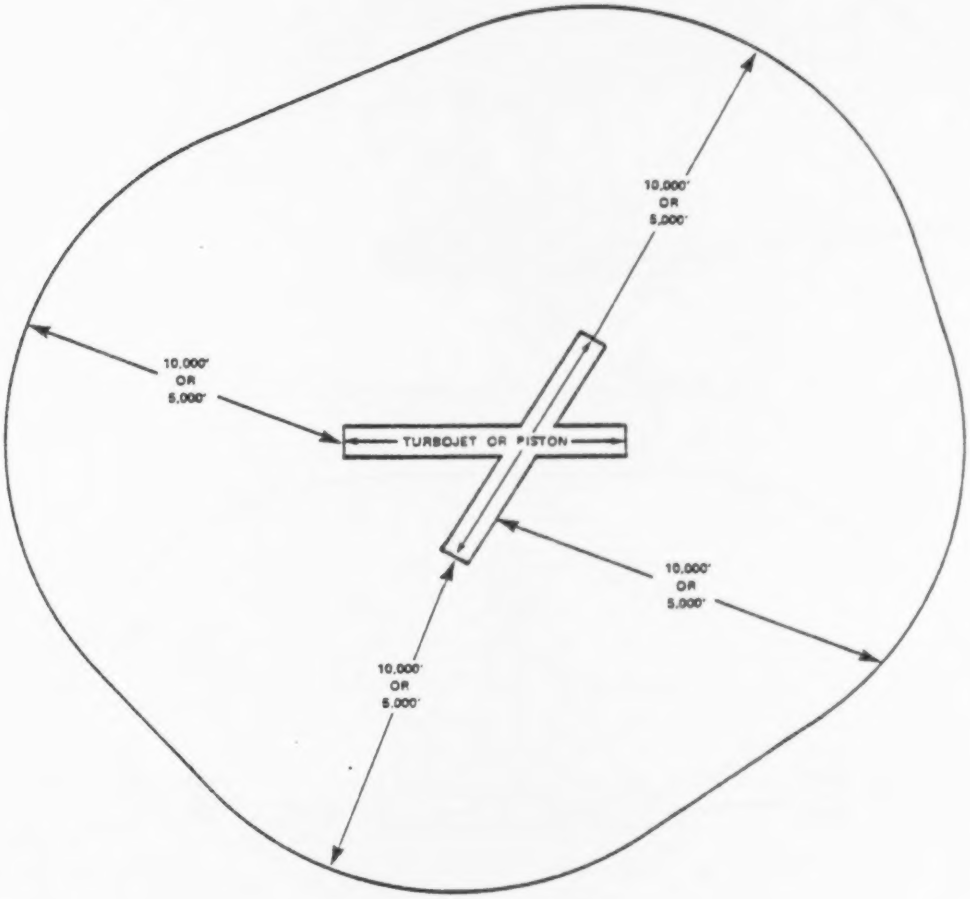
The distance from the runway is measured radially from the edge of the runway surface along the entire edge of the runway. Examples of measuring out from a runway are shown in Figure 2(c)-4.

The determination of distance can be made on recent USGS 7½ minute maps, scale aerial photos of the area, or plot plans of the facility and the surrounding area. Measurement to the disposal facility would be to the solid waste boundary, as defined on Page 4-1. There is the potential for a situation where the solid waste boundary is within the specified distance of the airport, yet the area of active disposal activities is outside the specified distance. State discretion should be used to resolve the issue, with consultation as necessary from the Federal Aviation Administration (FAA) or Fish and Wildlife Service (FWS). If no portion of the facility is within the 10,000- or 5,000-foot radial distance from the edge of the runway, *the facility does not require further evaluation for this Criterion*. If the facility or portion thereof lies within the specified distance, the evaluation should proceed to the next section.

3.2 Does the facility accept for disposal putrescible waste that may attract birds?

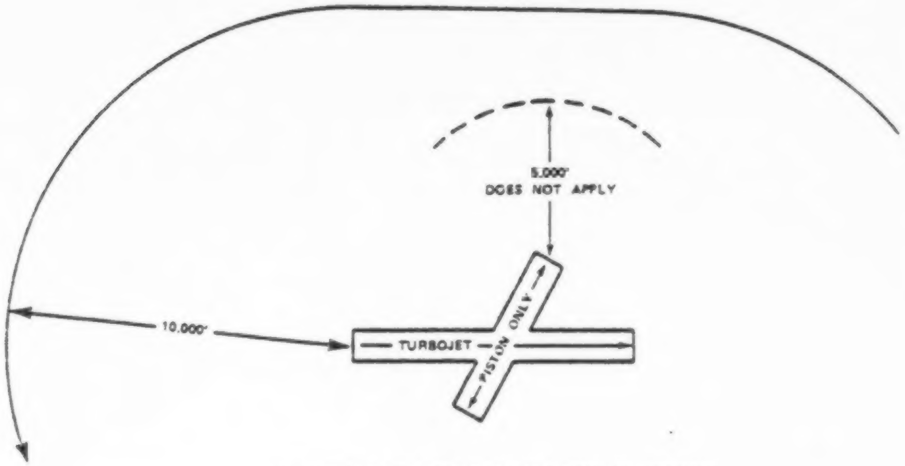
This determination is YES, if the disposal facility accepts any of the following:

- residential wastes
- food wastes, food marketing wastes, food processing wastes such as agricultural wastes, or food canning wastes
- sewage sludge
- septic tank pumpings
- animal manures
- animal carcasses
- processed putrescible wastes (e.g., shredded, baled, etc.)
- clean construction and demolition wastes containing organics (e.g., wood, tree stumps, etc.)
- similar putrescible wastes

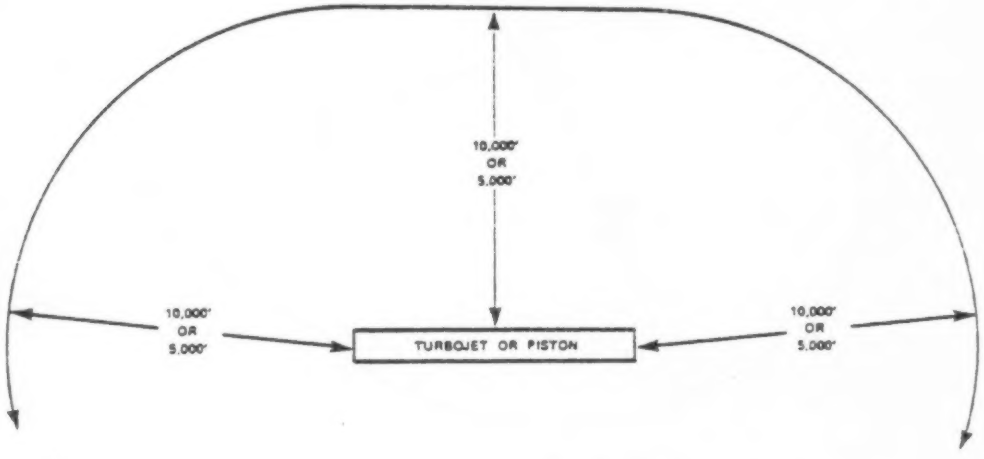

10,000'
OR
5,000'
10,000'
OR
5,000'
TURBOJET OR PISTON
10,000'
OR
5,000'
10,000'
OR
5,000'

A. BOTH RUNWAYS HANDLING SAME TYPE OF AIRCRAFT

Figure 2(c)-4. Measurement of Distance from Runway.


5,000'
DOES NOT APPLY
10,000'
TURBOJET
PISTON ONLY

B. RUNWAYS HANDLING DIFFERENT TYPES OF AIRCRAFT


10,000'
OR
5,000'
10,000'
OR
5,000'
TURBOJET OR PISTON
10,000'
OR
5,000'

C. SINGLE RUNWAY, EITHER TYPE OF AIRCRAFT

Figure 2(c)-4 (continued).
Measurement of Distance from Runway

This determination is NO, and *the facility does not require further evaluation for this Criterion,* if the facility receives only:

- fill dirt
- clean construction and demolition wastes containing no organics
- inorganic wastes such as ash, metals, plastics, glass, ceramic, rubber, mineral, or chemical wastes
- bulky wastes such as large auto parts, tires, stoves, and refrigerators unless they are an attractant to birds
- similar non-putrescible wastes

State discretion should be used if the facility receives only land clearing debris or some industrial wastes (e.g., leather, pulp, sawdust, etc.) which may or may not attract birds.

3.3 Does the disposal facility pose a bird hazard to aircraft?

3.3.1 Prioritization

In order to pose a bird hazard to aircraft, the disposal facility must attract birds and increase the likelihood of bird/aircraft collisions that may cause damage to the aircraft or injury to its occupants. Federal Aviation Administration Regional Office contacts are listed in Appendix 2(c)-1. These people are responsible for the regional airport certification and safety program. The complexity that can be involved in this determination precludes immediate evaluations of all of those facilities not previously eliminated. Therefore, it is recommended that facilities be ranked according to their potential to pose a bird hazard. The suggested order of ranking is:

(a) First Priority - Those facilities which are located within the specified distances of an airport, where the airport has been identified by FAA as having a solid waste related bird hazard. These airports are listed in Appendix 2(c)-2.

(b) Second Priority - Those facilities which are located within the specified distances of an airport, where the airport has been identified by FAA as having a bird hazard to aircraft. These airports are listed in Appendix 2(c)-3.

(c) Third Priority - Those facilities which are located within the specified distances of an airport known to the State Solid Waste Office as having a bird hazard to aircraft. A list of such facilities might be obtained from existing office records of:

- Previous complaints,
- Past inspection reports,
- Previous study or knowledge of a potential problem, and by contacting or referring to:
  - Airport owners/operators,
  - State aviation office,
  - U.S. Fish and Wildlife Service,
  - U.S. EPA Regional Offices,
  - State Wildlife offices,
  - Bird hazard specialists,
  - Airman's Information Manual, Part 3B (published by the National Flight Data Center).

(d) Lowest Priority - Those facilities which are located within the specified distances and have not previously been eliminated or ranked. The FAA states that many airport bird hazards may go unreported because many bird strikes result in no damage to the aircraft. Therefore, it is possible to have an unidentified airport bird hazard which may be caused by a nearby solid waste facility. The initial step in the evaluation procedure is to contact the airports near solid waste facilities that have been assigned the lowest priority to determine if there has been a history of unreported bird strikes or other evidence of a bird hazard, such as complaints by pilots about observed concentrations of birds. For these lowest priority facilities where there is no such evidence or history, *no further bird hazard evaluation is needed for purposes of the Inventory*. If previously unreported information indicates there may be a bird hazard at the airport, then the lowest priority facility should be elevated to a third priority for purposes of the evaluation procedure.

3.3.1 Evaluation

The following methodology for conducting the bird hazard evaluation involves, in part, observations of bird flight activity near the disposal facility and recording bird flight paths. This approach was developed in close consultation with the Federal Aviation Administration, Safety and Compliance Division, and the U.S. Fish and Wildlife Service, Animal Damage Control Program.

Non-compliance decisions are to be made by the State Solid Waste Office responsible for the Inventory, in consultation with the FAA, the State Aviation Office, the Fish and Wildlife Service, and the owners and operators of the airport and the disposal facility. Evaluations should be made in order of the first, second, and third priorities. The following guidance for these evaluations is presented in four parts.

Part 1 - The first step in the evaluation of the facilities is to check with the involved agencies for previous studies or documentation of a bird hazard. Where these are not available, an assessment of each facility will be required.

Part 2 - The second step in the evaluation is to determine the types of birds creating the bird hazard to aircraft, although it is not necessary to identify the exact species of birds. Certain types of birds are frequently observed at solid waste facilities and historically cause bird hazards. Gulls, starlings, blackbirds, crows, pigeons, grackles, sparrows, vultures, and waterfowl (in the case of surface impoundments) are the birds frequently attracted to disposal facilities that have caused problems for aircraft safety. Examples of birds commonly associated with airports can be found in Table 2(c)-1.

Several sources exist to determine the types of birds which could be expected to be found near the airport and disposal facility. While the airport or disposal facility operator may know some types of birds, more reliable sources are Animal Damage Control and Wildlife Assistance biologists from the U.S. Fish and Wildlife Service, State Wildlife

TABLE 2(c)-1. EXAMPLES OF BIRDS COMMONLY FOUND AT AIRPORTS

Black vulture	*Coragyps atratus*
Turkey vulture	*Cathartes aura*
Bobwhite	*Colinus virginianus*
Killdeer	*Charadrius vociferus*
Herring gull	*Larus argentatus*
Lesser black-backed gull	*Larus puscus*
Great black-backed gull	*Larus narinus*
Ring-billed gull	*Laraus delawarensis*
Mourning dove	*Zenaida macroura*
Rock dove	*Columba livia*
Common flicker	*Colaptes auratus*
Purple martin	*Progne subis*
Common crow	*Corvus brachyrhynchos*
Fish crow	*Corvus ossifragus*
Bluejay	*Cyanocitta cristata*
Mockingbird	*Minus polyglottos*
American robin	*Turdus migratorius*
Starling	*Sturnis vulgaris*
Red-winged blackbird	*Agelaius phoeniceus*
Eurasian tree sparrow	*Passer montanus*
House sparrow	*Passer domesticus*
Cattle egret	*Bubulcus ibis*
Common grackle	*Quiscalus quiscula*

agencies, the FAA regional chairman of the regional ad hoc bird hazard committee, local university biology departments, and local Audubon Society chapters. If, after well-documented consultation, the State determines that the bird hazard is caused by a species which does not frequent land disposal facilities in the airport vicinity, *then no further evaluation is needed for the purposes of the Inventory.*

Where it is found that the bird species of concern does frequent land disposal sites, the State should consult with these same agencies to determine the best time to visit the facility, since the likelihood of a particular species being in an area will vary with daily and seasonal fluctuations. For example, starlings do not pose a bird hazard problem during the Spring because the flocks of birds disperse during nesting season. Also gulls may only be present during certain seasons or during inclement weather. Some factors which must be considered are:

- Time of Year - Migration of birds and other factors result in different seasonal bird distributions.
- Time of Day - Bird flight activity is usually greatest early in the morning and toward sunset.
- Weather Conditions - Certain weather conditions may limit or enhance bird activity.
- Facility Operating Hours - Irregular schedules or short operating hours may cause irregular bird use.

After identifying the types of birds of concern and when they are most likely to be found in their greatest numbers, on-site evaluations can begin. If after sufficient study no birds are observed at the facility or the bird densities are less than or similar to densities of birds in the surrounding area where similar habitat is found, *then no further evaluation is needed.*

Determinations of non-compliance should be based on the results of several field inspections and previous study, if available. One field inspection is inadequate, since weather conditions or other factors may keep birds away from the site on any given day. If it is shown that bird species creating a hazard to aircraft are frequenting the disposal facility, *then further evaluation is necessary.*

Part 3 - It is now known that:

- The disposal facility is located within the applicable distance of a public-use airport,
- A bird hazard exists at the airport,
- The disposal facility receives putrescible waste, and
- Bird species known to pose a hazard to aircraft at the airport are attracted to the disposal facility in a density or concentration greater than naturally occurring in the area.

It remains to be determined whether the disposal facility contributes to the bird hazard at the airport or whether the bird hazard is solely due to other bird attractants, such as the airport itself or other off-site features. The determination will require visual observation and tracking of the birds to establish a link between the birds at the disposal facility and the airport. Because of considerable biological diversity among species of birds, and many other variables, no maximum or minimum number of site visits can be specified for the evaluation. If a link is observed between the facility and the airport on the first visit, that may be all that is necessary to identify the possible link for the different types of birds. The State Solid Waste Office, in consultation with the Fish and Wildlife Service (or other trained biologists), should decide the number and timing of visits necessary to reach a determination. The following steps are recommended:

(1) Select an observation site near the disposal facility which has an unobstructed view for observing birds arriving and departing the facility.

(2) Begin observation prior to the expected arrival time of the birds.

(3) Using binoculars (7 x 35 power recommended) observe birds flying toward and away from the facility, recording their flight directions on a map of suitable scale such as a USGS 7½-minute

series topographic map. By drawing a series of vectors to represent birds flying to or from the facility and recording bird overflights, it will be possible to record most of the bird flight activity.

(4) The vectors which represent the predominant use vector for incoming and outgoing bird flight paths should be extrapolated out away from the facility to represent likely flight paths (it is assumed that, unless unique terrain features exist, birds fly in relatively straight flight paths over a distance as short as one to two miles).

(5) It may be necessary that these vector extrapolations be confirmed where birds are observed following unique terrain features such as rivers, lakes, mountain passes, etc.

(6) Once the bird flight paths are confirmed, attempt to identify where birds are coming from or going to on a regular basis. There may be a bird roosting or loafing area nearby which, when identified and documented, could support the final determination.

(7) If the airport in question has an FAA-operated control tower, this same observation procedure can be conducted from the tower, confirming the vector extrapolations. FAA tower personnel may be able to confirm some of the bird flight paths observed at the facility. Aircraft flight paths can best be identified by talking to airport management and FAA personnel working at the airport. Many facilities utilized by air carriers have noise and planning documents which depict flight paths.

(8) Once the bird flight paths between the disposal facility and the airport are identified, the aircraft flight paths for instrument and visual approaches should be plotted on the same map. If birds are flying from the disposal facility over or to the airport, across aircraft traffic patterns, or spiral above the disposal facility and into the aircraft traffic pattern, *then the facility is not in compliance with the Criterion.*

(9) If bird flight paths are in close proximity to usual aircraft flight paths, possible variations in bird flight paths, as identified through more observations, should be considered. Flight paths of aircraft may also vary with aircraft speed and turning radius. A special case is the situation of surface impoundments which may be attractive to wading birds or waterfowl. Furthermore, these birds may fly to the site because they see the water from some distance; however, they may not land on the impoundment because of human activity and other variables. In evaluating impoundments, it may be worthwhile to compare waterfowl use with other impoundments in the area. If waterfowl are using other ponds it can be assumed that the facility impoundment will be attractive to birds, if not for loafing and feeding, then for possible overflight.

Part 4 - If the flight patterns of the birds cannot be clearly established based on direct visual observation as outlined above, it will be necessary to design the evaluation to consider all the bird attractants, including the waste disposal facility, in the area of the airport. Other methods can be used to do this such as marking the birds, radar tracking, collection of bird specimens and analysis of bird digestive organs, radio telemetry, and other complex techniques. The State Solid Waste Office should seek assistance from State and Federal biologists to develop an evaluation technique which supports the unique situation. Because Federal and State permits may be required, the Animal Damage Control biologist of the U.S. Fish and Wildlife Service should be contacted for advice on the permit requirements.

Typical attractants to be identified and considered are:

- Cropland
- Water, especially standing bodies of water and wetlands.
- Vegetation, especially forests
- Open areas - fields (especially recently disturbed), grasses, and golf courses

- Animal feeding operations
- Solid waste handling at the airport

The bird concentrations at the attractants should be identified and characterized. The characteristics of the bird concentrations at the airport, the disposal facility, and these other surrounding areas should be compared. Characteristics of bird concentration to be compared are:

- Species of birds - What species pose a hazard at the airport? Does the disposal facility, or other surrounding areas support this species?
- Number of birds - What is the approximate number of birds at the airport? Is it a flock, or single birds? Does the disposal facility or do the surrounding areas support this number of birds?
- Daily occurrence - What part of the day do the birds usually occur at the airport? Morning, evening, or all day? Does this bear any relationship to the daily occurrence of birds at the disposal facility or other surrounding areas?
- Seasonal occurrence - What are the seasonal patterns of birds at the airport? Are birds most numerous during spring and autumn migration or during winter due to heat and food availability at the disposal facility or other surrounding areas?
- Weather conditions - Are birds seeking shelter from inclement weather at the airport? Disposal facility? Surrounding areas?

After a comparison of the birds at the airport, the disposal facility, and other surrounding areas, evidence should be weighed to determine the attractant of the birds posing the hazard.

If the bird concentration at the airport and in the aircraft airspace appears to be more clearly related to the bird concentrations of other surrounding areas than to the bird population of the disposal facility, then the other surrounding areas pose as great a bird hazard and the disposal facility may be eliminated from further consideration.

If the birds at the airport appear to be more closely related to the birds at the disposal facility than to the birds of the other surrounding areas, then the disposal facility poses the bird hazard and is not in compliance with this Criterion.

Appendix 2(c)-1

LIST OF FAA REGIONAL OFFICES CONTACTS
AIRPORTS DIVISIONS

1. New England Region

Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut.

Airports Division, ANE-600
Federal Aviation Administration
12 New England Executive Park
Burlington, Massachusetts 01803

Commercial Telephone (617) 273-7235
FTS 8-836-1235

2. Eastern Region

New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, West Virginia, District of Columbia.

Airports Division, AEA-600
Federal Aviation Administration
Federal Building, Room 329
John F. Kennedy International Airport
Jamaica, New York 11430

Commercial Telephone (212) 995-8543
FTS 8-665-8543

3. Southern Region

Georgia, North Carolina, South Carolina, Florida, Puerto Rico, Virgin Islands, Tennessee, Kentucky, Mississippi, Alabama.

Airports Division, ASO-600
Federal Aviation Administration
3400 Whipple Street
East Point, Georgia, 30344

Commercial Telephone (404) 763-7288
FTS 8-246-7288

4. Great Lakes Region

Illinois, Indiana, Michigan, Wisconsin, Minnesota, Ohio.

Airports Division, AGL-600
Federal Aviation Administration
2300 East Devon Avenue
Des Plaines, Illinois 60018

Commercial Telephone (312) 694-4500, Ext. 2271
FTS 8-384-9271

5. Central Region
Kansas, Missouri, Iowa, Nebraska.

Airports Division, ACE-600
Federal Aviation Administration
Federal Building
601 East 12th Street
Kansas City, Missouri 64106

Commercial Telephone (816) 374-5278
FTS 8-758-5278

6. Southwest Region
Arkansas, Texas, Oklahoma, New Mexico, Louisiana.

Airports Division, ASW-600
Federal Aviation Administration
4400 Blue Mound Road
Fort Worth, Texas 76131

Commercial Telephone (817) 624-4911
FTS 8-736-9475

7. Rocky Mountain Region
Colorado, Wyoming, Utah, South Dakota, Montana, North Dakota.

Airports Division, ARM-600
Federal Aviation Administration
10455 East 25th Avenue
Aurora, Colorado 80010

Commercial Telephone (303) 837-3855
FTS 8-327-3855

8. Northwest Region
Washington, Idaho, Oregon.

Airports Division, ANW-600
Federal Aviation Administration
FAA Building, Boeing Field
King County International Airport
Seattle, Washington 98108

Commercial Telephone (206) 767-2740
FTS 8-396-2740

9. Western Region
California, Arizona, Nevada.

Airports Division, AWE-600
Federal Aviation Administration
15000 Aviation Boulevard
Lawndale, California 90261
Mail: P. O. Box 92007, Worldway Postal Center
Los Angeles, California 90009

Commercial Telephone	(213) 536-6240
FTS	8-966-6240

10. Alaskan Region
Alaska

Airports Division, AAL-600
Anchorage Federal Office Building
P. O. Box 14
701 C Street
Anchorage, Alaska 99513

Commercial Telephone	(907) 271-5438
FTS	8-399-0150 (Ask FTS Operator for 271-5438)

11. Pacific-Asia Region
Hawaii, Trust Territory of the Pacific Islands, American Samoa, Guam.

Airports Division, APC-600
Federal Aviation Administration
Prince Jonah Kuhio Kalanianaole Building
300 Ala Moana Boulevard
Honolulu, Hawaii 96813
Mail: P. O. Box 50109
Honolulu, Hawaii 96850

Commercial Telephone	(808) 546-7129
FTS	8-556-0220 (Ask FTS Operator for 546-7129)

Appendix 2(c)-2

AIRPORTS HAVING SOLID WASTE RELATED BIRD HAZARD*

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* Note that the disposal facilities considered by FAA may not necessarily be within the specified distances of these airports. Also, the listing is subject to updating by FAA.

AIRPORTS WITH BIRD HAZARDS

ALASKAN REGION

ASSOCIATED CITY	AIRPORT NAME
Kodiak, Alaska	Kodiak State
Homer, Alaska	Homer
Anchorage, Alaska	Merrill Field

NORTHWEST REGION

Renton, Washington	Renton Municipal
Hoquiam, Washington	Bowerman
Bremerton, Washington	Kitsap County

PACIFIC REGION

None

WESTERN REGION

San Francisco, California	San Francisco International
Oakland, California	Metropolitan Oakland
Stockton, California	Stockton Metropolitan
Santa Barbara, California	Santa Barbara Municipal
Concord, California	Buchanan Field

SOUTHWEST REGION

None

GREAT LAKES REGION

Benton Harbor, Michigan	Ross Field
Escanaba, Michigan	Delta County
Lansing, Michigan	Capital City
Duluth, Minnesota	Duluth International
International Falls, Minnesota	Falls International

AIRPORTS WITH BIRD HAZARDS (continued)

SOUTHERN REGION

ASSOCIATED CITY	AIRPORT NAME
Atlanta, Georgia	Hartsfield Atlanta International
Augusta, Georgia	Bush Field

CENTRAL REGION

Omaha, Nebraska	Eppley Airfield

ROCKY MOUNTAIN REGION

Salt Lake City, Utah	Salt Lake City International
Ogden, Utah	Ogden Municipal

NEW ENGLAND REGION

None

EASTERN REGION

Newark, New Jersey	Newark International
Trenton, New Jersey	Mercer County
Atlantic City, New Jersey	Atlantic City Municipal
Atlantic City, New Jersey	NAFEC/Atlantic City
New York, New York	John F. Kennedy International
New York, New York	La Guardia

Appendix 2(c)-3

AIRPORTS HAVING A KNOWN BIRD HAZARD WHERE CONTRIBUTIONS BY SOLID WASTE DISPOSAL FACILITIES ARE UNKNOWN*

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* Listing subject to updating by FAA

AIRPORTS WITH BIRD HAZARDS

ALASKAN REGION

ASSOCIATED CITY	AIRPORT NAME

None

NORTHWEST REGION

ASSOCIATED CITY	AIRPORT NAME
Seattle, Washington	Boeing Field/King County
Moses Lake, Washington	Grant County
Lewiston, Idaho	Lewiston-Nez Perce County
Pocatello, Idaho	Pocatello Municipal
Salem, Oregon	McNary Field
Medford, Oregon	Medford-Jackson County
Astoria, Oregon	Clatsop County
Idaho Falls, Idaho	Fanning Field

PACIFIC REGION

ASSOCIATED CITY	AIRPORT NAME
Pago Pago, Samoa	Pago Pago International
Honolulu, Hawaii	Honolulu International
Kahului, Hawaii	Kahului International
Lihue, Hawaii	Lihue International
Lanai City, Hawaii	Lanai

WESTERN REGION

ASSOCIATED CITY	AIRPORT NAME
Los Angeles, California	Los Angeles International
Sacramento, California	Sacramento Metropolitan
Sacramento, California	Sacramento Executive
Santa Ana, California	John Wayne/Orange County
Napa, California	Napa County
San Diego, California	San Diego International
Fresno, California	Fresno Air Terminal
Burbank, California	Hollywood Burbank
Santa Monica, California	Santa Monica Municipal
Livermore, California	Livermore
Palo Alto,California	Palo Alto

AIRPORTS WITH BIRD HAZARDS (continued)

ASSOCIATED CITY	AIRPORT NAME
	WESTERN REGION (continued)
Long Beach, California	Long Beach/Daugherty Field
Santa Maria, California	Santa Maria Public
Torrance, California	Torrance Municipal
Compton, California	Compton Airport
Phoenix, Arizona	Phoenix-Sky Harbor
Reno, Nevada	Reno International
	SOUTHWEST REGION
Tulsa, Oklahoma	Tulsa International
Lawton, Oklahoma	Lawton Municipal
New Orleans, Louisiana	Lakefront International
New Orleans, Louisiana	New Orleans International
Monroe, Louisiana	Monroe Regional
	GREAT LAKES REGION
South Bend, Indiana	Michiana Regional
Detroit, Michigan	Detroit City
Detroit, Michigan	Detroit Metropolitan
Detroit, Michigan	Willow Run
Grand Rapids, Michigan	Kent County International
Kalamazoo, Michigan	Kalamazoo Municipal
Muskegon, Michigan	Muskegon County
Chicago, Illinois	Merrill C. Meigs
Chicago, Illinois	Chicago Midway
Moline, Illinois	Quad City
Alexandria, Minnesota	Chandler Field
St. Paul, Minnesota	Holman Field
Appleton, Wisconsin	Outagamie County
Green Bay, Wisconsin	Austin-Straubel Field
La Crosse, Wisconsin	La Crosse Municipal
Manitowoc, Wisconsin	Manitowoc County
Milwaukee, Wisconsin	General Mitchell Field
Oshkosh, Wisconsin	Wittman Field

AIRPORTS WITH BIRD HAZARDS (continued)

ASSOCIATED CITY	AIRPORT NAME
SOUTHERN REGION	
Tampa, Florida	Tampa International
Sarasota/Bradenton, Florida	Sarasota-Bradenton
Ft. Myers, Florida	Page Field
Miami, Florida	Miami International
Orlando, Florida	Orlando International
St. Petersburg/Clearwater, Florida	St. Petersburg/Clearwater Int'l
Melbourne, Florida	Melbourne Regional
Marathon, Florida	Marathon Flight Strip
Jacksonville, Florida	Jacksonville International
Key West, Florida	Key West International
Lake Okeechobee	Lake Okeechobee Municipal
Brunswick, Georgia	Glynco Jetport
Birmingham, Alabama	Birmingham Municipal
Muscle Shoals, Alabama	Muscle Shoals
Anniston, Alabama	Anniston - Calhoun County
Louisville, Kentucky	Standford Field
Lexington, Kentucky	Blue Grass
Wilmington, North Carolina	New Hanover County
Memphis, Tennessee	Memphis International
Nashville, Tennessee	Nashville Metropolitan
Christiansted, Virgin Islands	Alexander Hamilton
San Juan, Puerto Rico	Puerto Rico International
CENTRAL REGION	
Wichita, Kansas	Wichita Mid-Continent
Sioux City, Iowa	Mason City Municipal
Columbia, Missouri	Columbia Regional
St. Louis, Missouri	Lambert-St. Louis International
Kaiser, Missouri	Lee C. Fine Memorial
Cape Girardeau, Missouri	Cape Girardeau Municipal

AIRPORTS WITH BIRD HAZARDS (continued)

ASSOCIATED CITY	AIRPORT NAME
ROCKY MOUNTAIN REGION	
Bismarck, North Dakota	Bismarck Municipal
Watertown, South Dakota	Watertown Municipal
Helena, Montana	Helena
Cody, Wyoming	Cody Municipal
NEW ENGLAND REGION	
Willimantic, Connecticut	Willimantic - Windom
New Haven, Connecticut	Tweed - New Haven
Boston, Massachusetts	General Edward Lawrence Logan
Hyannis, Massachusetts	Barnstable Municipal
EASTERN REGION	
Buffalo, New York	Greater Buffalo International
Ithaca, New York	Tompkins County
Islip, New York	Islip McArthur
Teterboro, New Jersey	Teterboro
Farmingdale, New York	Republic Airport
Poughkeepsie, New York	Dutchess County
Harrisburg, Pennsylvania	Capital City

CHAPTER 2(c)

SAFETY - BIRD HAZARDS TO AIRCRAFT

Criterion Compliance Decision

☐ *Does Not Require Further Regulation*

☐ *Does Not Comply*

1. Is the disposal facility within the specified distances of a public-use airport?

☐ YES (continue to 2)

- ☐ 10,000 feet from any airport runway used by turbojet aircraft
- ☐ 5,000 feet from any airport runway used only by piston-type aircraft

☐ NO (*DOES NOT REQUIRE FURTHER EVALUATION*)

2. Does the facility accept for disposal putrescible waste that may attract birds?

☐ YES (continue to 3)

- ☐ Residential wastes
- ☐ Food waste
- ☐ Sewage sludge, septic tank pumpings
- ☐ Animal manures
- ☐ Animal carcasses
- ☐ Processed putrescible wastes
- ☐ Construction wastes with organics
- ☐ Other ____________________

☐ NO (*DOES NOT REQUIRE FURTHER EVALUATION*)

- ☐ Fill dirt
- ☐ Construction wastes with no organics
- ☐ Inorganic wastes
- ☐ Bulk wastes
- ☐ Other ____________________

3. Does the disposal facility pose a bird hazard to aircraft?

Prioritization:

- ☐ Facility within specified distances of an airport listed by FAA as having a solid waste related bird hazard - priority 1
- ☐ Facility within specified distances of an airport listed by FAA as having a bird hazard - priority 2
- ☐ Facility within specified distances of an airport known to the State as having a bird hazard - priority 3

CHAPTER 2(c)

SAFETY - BIRD HAZARDS TO AIRCRAFT

(continued)

☐ Facility within specified distances of an airport with no known bird hazard - priority 4

Assessment:

Assessment Factors

☐ Bird species ______________________________

☐ Number of birds ______________________________

☐ Patterns of occurrence ______________________________

☐ Weather conditions ______________________________

☐ Other attractants ______________________________

☐ YES (*DOES NOT COMPLY*)

☐ Flight patterns of the birds show that birds do fly from the disposal facility into or across the airport area

☐ Bird populations at the facility are more closely related to bird populations at the airport than populations in the surrounding areas.

☐ NO (*DOES NOT REQUIRE FURTHER EVALUATION*)

☐ Bird populations of the facility are less than or equal to the natural populations in the area

☐ Bird attraction is due to the airport facility or other attractant

☐ Flight patterns of birds show that they do not fly from the disposal facility into or across the airport area

CHAPTER 2(d)

SAFETY - ACCESS

1.0 Criterion and Definitions

> **(d)** ***Access.*** **A facility or practice shall not allow uncontrolled public access so as to expose the public to potential health and safety hazards at the disposal site.**

2.0 Inventory Procedure

Injury to persons may result from the materials and activities associated with solid waste disposal facilities. The sources of hazards include:

(a) operation of heavy equipment and haul vehicles;
(b) exposure to waste including sharp objects, pathogens, and toxic, explosive, or flammable materials;
(c) accidental or intentional fires; and
(d) excavations and earth-moving activities.

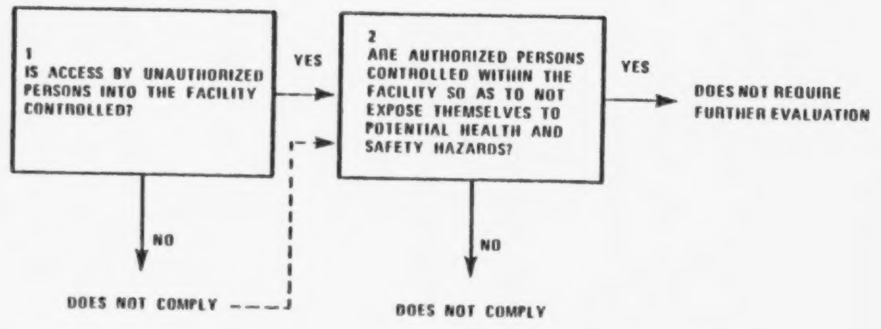
For purposes of the Inventory the public is defined as "authorized persons" and "unauthorized persons." Authorized persons are those with permission to be on or within the facility.

A determination of non-compliance with the Criterion involves evaluation of measures to control entry of the public to the facility and, where appropriate, control authorized persons within the facility so as to protect them from potential health and safety hazards. The decision flow chart is shown in Figure 2(d)-1.

3.0 Resolution of Decision Flow Chart Questions

3.1 Is access of unauthorized persons into the facility controlled?

Facility access must be controlled to prevent unauthorized persons from entering the facility. This is accomplished through:


1
IS ACCESS BY UNAUTHORIZED PERSONS INTO THE FACILITY CONTROLLED?
YES
NO
DOES NOT COMPLY
2
ARE AUTHORIZED PERSONS CONTROLLED WITHIN THE FACILITY SO AS TO NOT EXPOSE THEMSELVES TO POTENTIAL HEALTH AND SAFETY HAZARDS?
YES
DOES NOT REQUIRE FURTHER EVALUATION
NO
DOES NOT COMPLY

NOTE: DASHED LINE INDICATES THE NEED TO CONTINUE TO THE NEXT FLOWCHART QUESTION

FIGURE 2(d)-1 FLOW CHART–SAFETY–ACCESS

1/81

(1) artificial (man-made) control, and/or
(2) natural controls

Non-compliance with this Criterion is based on a facility-specific determination of the facility's physical constraints to access by unauthorized persons.

The sources of information needed to make the determinations are:

(1) review of the past history of the facility through:
    (a) previous inspections, records and permit conditions indicating controlled access into the facility
    (b) records of accidents at the facility due to a lack of controlled access
(2) field inspection

The assessment should be based on the following:

(1) Artificial controls
    (a) Gates - Access at all facilities should be limited to entrances that have gates which can be locked when the site is unsupervised. Depending on the natural controls present at the facility, entrance gates may be all that are needed to control unauthorized entry.
    (b) Fences - Fencing requirements are dependent on the natural controls and remoteness of the facility. At some facilities it is necessary to construct fences at selected points along the boundary or in some cases along the circumference of the facility to keep out unauthorized persons. This is especially true if the facility is located in an urban area associated with high usage and close proximity to populated areas. The type of fencing needed (chain link, farm type, etc.) is also facility specific according to the needs of the facility.
    (c) Perimeter patrol

(2) Natural Controls - The topography and vegetation on or near the facility may be adequate to control access. Examples of natural controls existing or developed at a facility are trees, hedges, berms, ditches, cliffs, ravines or embankments associated with railroads and roadways. At some remote facilities access control (other than locked gates) may be satisfied by the distance of the facility from a major roadway or by its location within a larger land area where the access by the public is restricted. If access to the facility is not controlled in the judgment of the State solid waste agency, *the facility does not comply.*

3.2 Are authorized persons controlled within the facility so as to not expose them to potential health and safety hazards?

Methods of control of authorized persons within the facility include the following:

- verbal and written instructions
- unloading area supervision
- lighting
- information and directional signs
- prohibition of scavenging
- control of salvaging
- trafficable roadways
- alternate discharge point
- internal fencing or barriers (berms, ditches, etc.)

The sources of information needed to make this determination are:

(1) Review of the past history of the facility through:
  (a) Previous inspections, records and permit conditions indicating control methods within the facility
  (b) Records of accidents at the facility due to inadequate control

(2) Field inspection

The assessment should be based on the following:

(1) Verbal and written instructions provided at the facility or by facility personnel should be clear, concise, and readily available. Verbal instructions should be provided only by appropriate personnel.

(2) Supervision of the unloading area(s) should occur in a manner which clearly directs users as to where and where not to discharge wastes. This supervision must take place whenever the landfill gates are unlocked.

(3) For those facilities operating after dark, lighting must be provided at the unloading area.

(4) Information and directional signs may be necessary. A facility may need to have such information as hours of operation, authorized users, waste types accepted or excluded, where specific waste types or vehicle types are to be unloaded, appropriate warning signs, owner or operator emergency telephone numbers, and facility rules posted at the entrance and within the facility. Directional signs may be necessary within the facility to direct drivers to the appropriate unloading area, to assist in traffic control and to regulate speed within the facility.

(5) Scavenging (the uncontrolled removal of materials at a disposal facility) should not be allowed.

(6) Salvaging is the controlled removal and handling of waste material for utilization. Examples of salvageable material are metals, glass, paper, bricks, and bulky items. Evaluation in this case must focus on the salvaging procedures. Generally, the material to be salvaged should not be unloaded at the working face but should be unloaded at a separate salvage area. Materials should be removed from the facility daily or properly stored so they do not create a hazard.

(7) Trafficable Roadways - Internal access roads should be maintained so that traffic will flow smoothly and will not be interrupted by inclement weather.

(8) Provisions for Alternate Discharge Point - Bulk containers or roll-off units may be provided at an unloading area at a separate location within the facility for small vehicles to dispose of waste. This area should be located away from the working face to reduce the potential for accidents.

(9) Internal fencing or barriers (berms, ditches, etc.) may be used to control the movement of vehicles or persons within the facility.

If control over authorized persons within the facility is inadequate, based on State judgment, *the facility does not comply.*

CHAPTER 2(d)

SAFETY - ACCESS

Criterion Compliance Decision

☐ *Does Not Require Further Evaluation*

☐ *Does Not Comply*

1. Is access by unauthorized persons into the facility controlled?

☐ YES (continue to 2)

Artificial controls:

☐ Gates
☐ Fences
☐ Perimeter patrol

Natural controls:

☐ Trees and hedges
☐ Berms and ditches
☐ Cliffs and ravines or embankments associated with railways and roadways
☐ Remoteness

☐ NO (*DOES NOT COMPLY* - continue to 2)

☐ Violation of permit conditions indicating controlled access
☐ Records of accidents at facility due to lack of access control

2. Are authorized persons controlled within the facility so as not to expose them to potential health and safety hazards?

☐ YES (*DOES NOT REQUIRE FURTHER EVALUATION*)

☐ Verbal and written instructions
☐ Supervision of the unloading area
☐ Adequate lighting
☐ Posting information and direction signs
☐ Prohibition of scavenging
☐ Control of salvaging
☐ Trafficable roadways
☐ Alternate discharge point
☐ Internal fencing or barriers

☐ NO (*DOES NOT COMPLY*)

☐ Records of accidents at facility due to lack of internal access control
☐ Field inspection and/or records indicate that suitable methods of internal access control are not practiced.

CHAPTER 3

SURFACE WATER

1.0 Criterion and Definitions

§ 257.3-3 Surface Water.

(a) A facility or practice shall not cause a discharge of pollutants into waters of the United States that is in violation of the requirements of the National Pollutant Discharge Elimination System (NPDES) under Section 402 of the Clean Water Act, as amended.

(b) A facility or practice shall not cause a discharge of dredged material or fill material to waters of the United States that is in violation of the requirements under Section 404 of the Clean Water Act, as amended.

(c) A facility or practice shall not cause non-point source pollution of waters of the United States that violates applicable legal requirements implementing an areawide or Statewide water quality management plan that has been approved by the Administrator under Section 208 of the Clean Water Act, as amended.

(d) Definitions of the terms "Discharge of dredged material", "Point source", "Pollutant", "Waters of the United States", and "Wetlands" can be found in the Clean Water Act, as amended, 33 U.S.C. 1251 et seq., and implementing regulations, specifically 33 CFR Part 323 (42 FR 37122, July 19, 1977). *

2.0 Inventory Procedure

The Inventory classification procedure consists of identifying any of the following Clean Water Act requirements with which the facility does not comply:

- Section 404
- Section 402 (National Pollutant Discharge Elimination System)
- Applicable legal requirements implementing plans developed and approved under Section 208.

Requirements of Sections 404 and 402 relate to point source discharges of pollutants, while requirements of Section 208 plans address non-point source discharges. The procedure is to first determine whether any of these requirements are applicable to the facility, and if so, whether the facility does not comply. The decision procedure flow chart is shown in Figure 3-1.

---

* The correct citation should be 40 CFR Part 122 (45 FR 33420-33425, May 19, 1980). A technical amendment will soon be issued to change the present citation.

A disposal facility operating within the waters of the United States will require a Section 404 permit. The types of disposal activities covered by the 404 permit program include the addition of dredged material and fill material (e.g., solid waste, garbage, sludge, and the placement of dikes or levees) into the waters of the United States.

All other discharges of pollutants from disposal facilities to the waters of the United States will require a Section 402 (NPDES) permit. This may include discharges of collected or treated leachate and channeled surface water runoff.

Approved State-wide and area-wide 208 water quality management plans address non-point source pollution of surface waters. A facility located in an area covered by a 208 plan, which is implemented by legal requirements for control of non-point source pollution from solid waste disposal facilities, must comply with such requirements.

2.1 Definitions

The following definitions are from the Consolidated Permit Regulations for the 402 (NPDES) permit program and State-administered 404 permit programs (40 CFR 122).

(a) "Discharge of Pollutant(s)" includes (in reference to waters of the United States): any addition of any pollutant or combination of pollutants to waters of the U.S. from any point source, or ... surface runoff which is collected or channeled by man; discharges through pipes, sewers, or other conveyances owned by a State, municipality, or other person which do not lead to treatment works; and discharges through pipes, sewers, or other conveyances leading into privately owned treatment works.

(b) "Point source" means any discernible, confined, and discrete conveyance, including but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container,

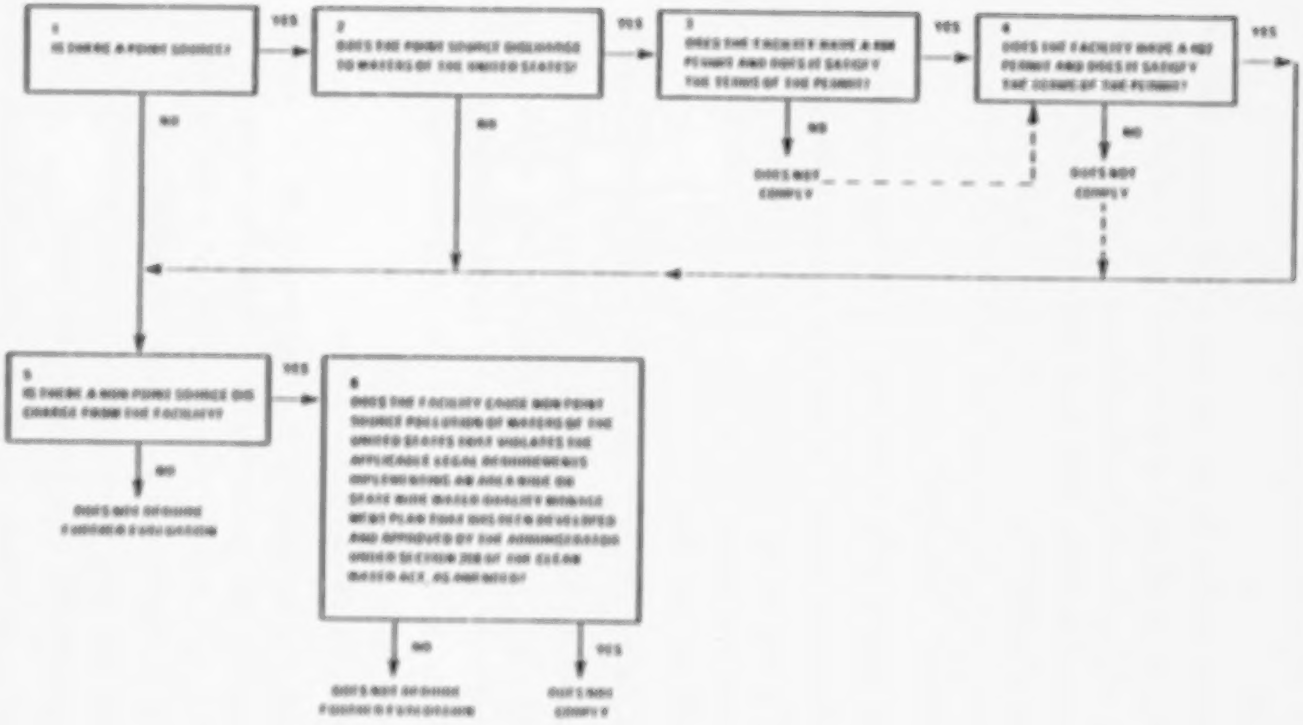

1
IS THERE A POINT SOURCE?
YES
2
DOES THE POINT SOURCE DISCHARGE TO WATERS OF THE UNITED STATES?
YES
3
DOES THE FACILITY HAVE A [illegible] PERMIT AND DOES IT SATISFY THE TERMS OF THE PERMIT?
YES
4
DOES THE FACILITY HAVE A [illegible] PERMIT AND DOES IT SATISFY THE TERMS OF THE PERMIT?
YES
NO
NO
NO
DOES NOT COMPLY
NO
DOES NOT COMPLY
5
IS THERE A NON-POINT SOURCE DISCHARGE FROM THE FACILITY?
YES
NO
DOES NOT REQUIRE FURTHER EVALUATION
6
DOES THE FACILITY CAUSE NON-POINT SOURCE POLLUTION OF WATERS OF THE UNITED STATES THAT VIOLATES THE APPLICABLE LEGAL REQUIREMENTS IMPLEMENTING AN AREA-WIDE OR STATE-WIDE WATER QUALITY MANAGEMENT PLAN THAT HAS BEEN DEVELOPED AND APPROVED BY THE ADMINISTRATOR UNDER SECTION 208 OF THE CLEAN WATER ACT, AS AMENDED?
NO
DOES NOT REQUIRE FURTHER EVALUATION
YES
DOES NOT COMPLY

FIGURE 3 1 FLOW CHART SURFACE WATER

rolling stock, concentrated animal feeding operations, vessel or other floating craft, from which pollutants are or may be discharged. This term does not include return flows from irrigated agriculture.

(c) "Pollutant" means dredged spoil, solid waste, incinerator residue, filter backwash, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials (except those regulated under the Atomic Energy Act of 1954, as amended) heat, wrecked or discarded equipment, rock, sand, cellar dirt, and industrial, municipal, and agricultural waste discharged into water.

(d) "Waters of the United States." This term includes:

(1) All waters which are currently used, were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide;

(2) Interstate waters, including interstate wetlands;

(3) All other waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, "wetlands," sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, the use, degradation, or destruction of which would affect or could affect interstate or foreign commerce including any such waters:

- which are or could be used by interstate or foreign travelers for recreational or other purposes;
- from which fish or shellfish are or could be taken and sold in interstate or foreign commerce;
- which are used or could be used for industrial purposes by industries in interstate commerce;

(4) All impoundments of waters otherwise defined as waters of the United States under this paragraph;

> (5) Tributaries of waters identified in paragraphs (1) to (4) of this section;
>
> (6) The territorial sea; and
>
> (7) "Wetlands" adjacent to waters (other than waters that are themselves wetlands) identified in paragraphs (1) to (6) of this section. ("Wetlands" means those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.
>
> Waste treatment systems, including treatment ponds or lagoons designed to meet the requirements of the CWA [other than cooling ponds as defined in 40 CFR Section 423.11(m)...] are not waters of the United States. This exclusion applies only to man-made bodies of water...

(e) "Discharge of dredged material" means any addition from any point source of dredged material into the waters of the United States. The term includes the addition of dredged material into waters of the United States and the runoff or overflow from a contained land or water dredged material disposal area. Discharges of pollutants into waters of the United States resulting from the onshore subsequent processing of dredged material, are not included within this term and are subject to Section 402 of the Clean Water Act even though the extraction and deposit of such material may require a permit from the Corps of Engineers or the State Section 404 Program.

(f) "Discharge of fill material" means the addition from any point source of fill material into waters of the United States. The term includes the following activities in the waters of the United States: placement of fill that is necessary to the construction of any structure, the building of any structure, the building of any structure or impoundment requiring rock, sand, dirt, or other material for its construction; site-development fills for recreational, industrial, commercial, residential, and other uses; causeways or road fills; dams and dikes, artificial islands; property protection and/or reclamation devices such as riprap, groins, seawalls, breakwaters, or revetments, beach nourishment; levees; fill for structures such as sewage treatment facilities, intake and outfall pipes associated with power plants, and subaqueous utility lines; and artificial reefs.

(g) "Dredged material" means material that is excavated or dredged from waters of the United States.

(h) "Fill material" means any "pollutant" which replaces portions of the waters of the United States with dry land or which changes the bottom elevation of a water body for any purpose.

3.0 Resolution of Decision Flow Chart Questions

The 402 program is administered by EPA and approved States. The 404 permit program is currently administered by the Corps of Engineers. The 208 program is administered by State and Regional Agencies.

In assessing facilities against this Criterion the State Solid Waste Agency is advised to consult with the State Water or another appropriate agency (e.g., the agency which runs the State 402, 404, or 208 program). Where no State Agency is approved to run the 402 or 404 program under the Clean Water Act, the Environmental Protection Agency or the Corps of Engineers should be consulted. For those States with approved 208 plans, the State office in charge of preparing and implementing the plan should be consulted. However, decisions made for purposes of the Inventory, though based on consultations with other agencies, are the responsibility of the State Solid Waste Agency.

3.1 Is there a point source?

A facility with a point source discharge of pollutants to the waters of the United States violates this Criterion unless it has applied for, or is operating in compliance with, a 404 permit or, in some cases, a 402 (NPDES) permit.

A facility without a point source does not violate this portion of the Criterion. Facilities with point sources need to be evaluated only if they discharge to waters of the United States. Possible point sources at a facility include the direct dumping of solid waste, the discharge of pollutants from conventional sources (e.g., pipes, outfalls), and the discharge of surface runoff which is collected or channeled by man.

To determine whether there is a point source discharge of pollutants, check the facility location, design and operational history, conduct a field inspection, and check with the appropriate 402 or 404 permit program to see whether the facility has a point source discharge of pollutants. The following are examples of point sources at landfills, surface impoundments, and landspreading facilities:

- A discharge of pollutants from a leachate collection system including leachate from discrete channels or fissures (402).
- A direct discharge of pollutants from an on-site leachate treatment system. Leachate that is conveyed to off-site treatment facilities (e.g., sewage treatment plants) is not considered as a point source discharge from the facility (402).
- A discharge of surface runoff which is collected or channeled by man through clearly delineated outflows such as discharges from pipes, outfalls, spillway structures, and channels (402).
- Location of the facilities in waters of the United States (404).

If there is no point source, *no further evaluation is necessary regarding this portion of the Criterion*; continue to Section 3.5 for non-point source determination. If a facility is suspected of having a point source, it needs to be evaluated to determine if it discharges to waters of the United States.

3.2 Does the point source discharge to waters of the United States?

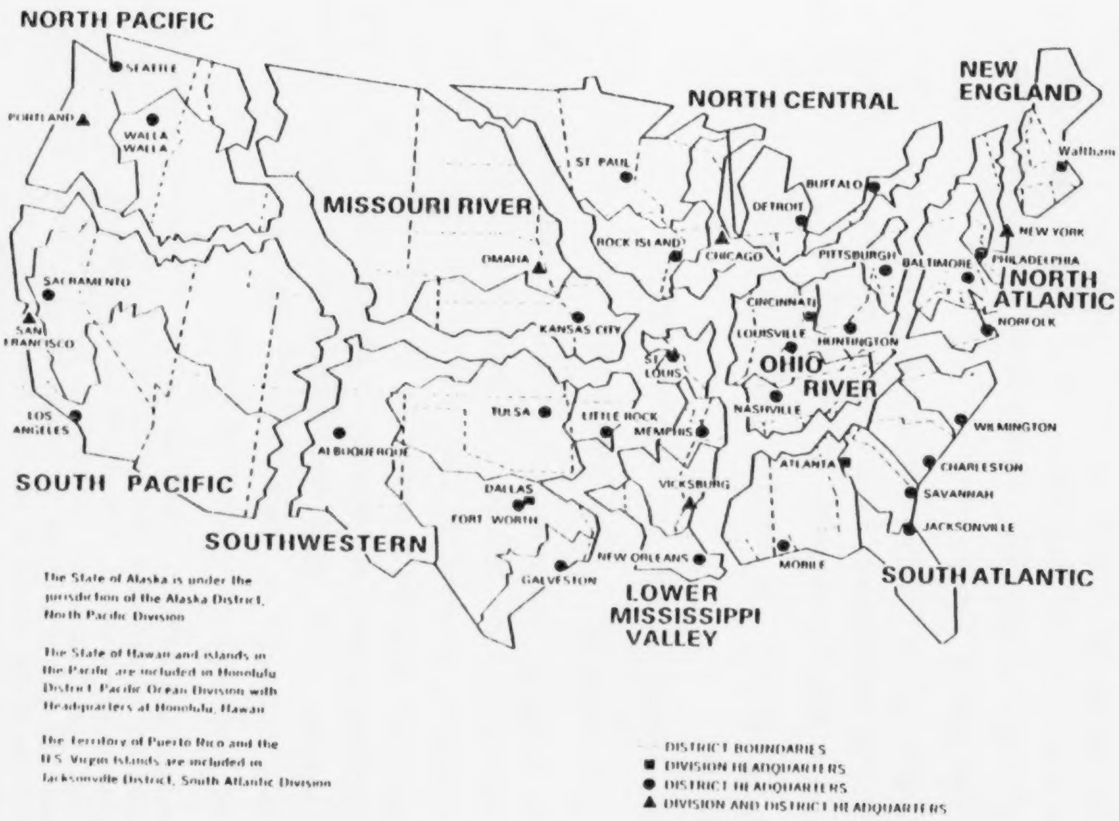
The determination of whether a point source discharges to the waters of the United States is obvious in many cases. Permit information or field inspection can be used to determine the location of leachate, surface water runoff, and dredging or filling discharges with respect to any waters of the United States. The determination will not always be obvious, however, particularly in areas that are not inundated at all times of the year. Examples might be:

- Some wetlands.
- Mudflats and sandflats.
- Intermittent freshwater streams (where the discharge takes place).

In these instances, information on whether the point source discharges into the "waters of the United States," and the boundaries of those waters might be obtained through the District Office of the Corps of Engineers (see Figure 3-2), the State Water Agency, or the (EPA) Regional NPDES Agency. Other possible sources of information include:

- State and local wetland maps (including local conservation agency maps).
- Maps from the State Coastal Zone Management Agency.
- United States Fish and Wildlife Service, USDI (including the National Wetlands Inventory maps).
- United States Geological Survey.
- Soil Conservation Service.
- Examination of the prevalent vegetation near the solid waste boundary for vegetation typically adapted for life in saturated soil conditions (hydrophytes).
- Title 33 - Navigation and Navigable Waters, Regulatory Programs of the Corps of Engineers, FR 42(138):37122-37164.

If the facility has a discharge of dredged or fill material to waters of the United States, a 404 permit is required. If there is a discharge of some other pollutant to the waters of the United States (e.g., collected or treated leachate, channeled surface water runoff), a 402 permit is required. If no permit is required, *no further*


NORTH PACIFIC
SEATTLE
PORTLAND
WALLA WALLA
SACRAMENTO
SAN FRANCISCO
LOS ANGELES
SOUTH PACIFIC
MISSOURI RIVER
OMAHA
KANSAS CITY
ALBUQUERQUE
SOUTHWESTERN
TULSA
DALLAS
FORT WORTH
GALVESTON
LITTLE ROCK
NORTH CENTRAL
ST. PAUL
ROCK ISLAND
CHICAGO
DETROIT
BUFFALO
ST. LOUIS
MEMPHIS
VICKSBURG
NEW ORLEANS
LOWER MISSISSIPPI VALLEY
CINCINNATI
LOUISVILLE
PITTSBURGH
HUNTINGTON
NASHVILLE
OHIO RIVER
ATLANTA
MOBILE
NEW ENGLAND
Waltham
NEW YORK
PHILADELPHIA
BALTIMORE
NORFOLK
NORTH ATLANTIC
WILMINGTON
CHARLESTON
SAVANNAH
JACKSONVILLE
SOUTH ATLANTIC
--- DISTRICT BOUNDARIES
■ DIVISION HEADQUARTERS
● DISTRICT HEADQUARTERS
▲ DIVISION AND DISTRICT HEADQUARTERS

The State of Alaska is under the jurisdiction of the Alaska District, North Pacific Division

The State of Hawaii and islands in the Pacific are included in Honolulu District, Pacific Ocean Division with Headquarters at Honolulu, Hawaii

The Territory of Puerto Rico and the U.S. Virgin Islands are included in Jacksonville District, South Atlantic Division

FIGURE 32 DISTRICT OFFICES OF THE U.S. ARMY CORPS OF ENGINEERS

evaluation is necessary for this portion of the Criterion; continue to Section 3.5 for non-point source determination.

3.3 Does the facility have a 404 permit and does it satisfy the terms of the permit?

If a facility discharges dredged or fill material into waters of the United States and is not in compliance with, has not applied for, or has been denied a 404 (dredge and fill) permit, *then it does not comply with this portion of the Criterion.**

The above determination can be made by contacting the District Office of the Corps of Engineers, using in-house records, or using information from the owner or operator of the facility.

It should be noted that the Corps of Engineers issues three types of 404 permits:

- Individual, issued through the District Office.
- General (200 existing), issued through the District Offices.
- Nationwide permits. Information on these can be obtained from the District Engineer's Office or by consulting 33 CFR Section 323.4 (Regulatory Programs of the Corps of Engineers). The most significant nationwide permit is the one covering discharges into streams above their headwaters and into certain isolated waters. Thus, some facilities or discharges of dredged or fill material might not have an individual permit, but might fall under a general or nationwide permit.

* NOTE: The definition of fill material in the Consolidated Permit Regulations eliminated the "primary purpose test." This test was previously used to determine if a discharge of fill material (at a facility located in the waters of the United States) was primarily for purposes of fill (404) or disposal (402). From the results of that test a determination could be made as to whether a facility's discharge required a 402 or 404 permit. The new definition implicitly includes solid waste, garbage, and sludge as fill material because they are defined as pollutants, and adding these pollutants to the waters of the United States would result in filling in those waters or changing the bottom elevation of a water body. These new regulations [40 CFR 122.51(c)(2)(ii)] provide that

discharges of fill material are regulated under Section 404 and do not require NPDES permits. However, the Corps of Engineers dredge and fill regulations (33 CFR 323) had not been revised to reflect this change, and discussions between EPA and the Corps were in progress at the time of publication of this edition of the Inventory Guidance Manual.

Pending revision of the Corps of Engineers regulations, permit applications should be directed to the proper authority (402 or 404) based on the definitions established in the Consolidated Permit Regulations. Any facility located in the waters of the United States whose application for a permit has been submitted but has not been processed will not require further evaluation for purposes of this part of the Surface Water Criterion.

Of course, there may be situations where leachate from such a disposal facility (i.e., dredged or fill material) is collected and subsequently discharged into the water from a point source. Such a discharge of leachate or channeled surface water runoff would require an NPDES permit and the facility should be evaluated under Section 3.4.

3.4 Does the facility have a 402 permit and does it satisfy the terms of the permit?

If a facility has a point source discharge not covered by 404 and it is not operating in compliance with or has not applied for a 402 (NPDES) permit, *then it does not comply with this part of the Criterion.* Information on 402 permit applications may be found in the Consolidated Permit Regulations, Part XI, Consolidated Permit Application Forms for EPA Programs (45 FR 33517-33588, May 19, 1980).

The above determinations can be made in the office by contacting the State NPDES program (if the State has authority over the program) or the Regional Office of the Federal EPA.

3.5 Is there a non-point discharge from the facility?

Surface impoundments do not have non-point source discharges unless there is leakage, frequent spillage, or overtopping. Land-spreading facilities and landfills that collect and contain all runoff and other surface waters on site are also assumed to have no non-point source discharges because such facilities either evaporate such discharges or release them as a point source. It is assumed that all other facilities have a non-point source discharge.

3.6 Does the facility cause non-point source pollution of the waters of the United States that violates applicable legal requirements implementing an area-wide or State-wide water quality management plan that has been developed and approved by the Administrator under Section 208 of the Clean Water Act, as amended?

This assessment should begin by first determining if the facility is located in an area with an approved 208 plan (see Table 3-1). This can be done by contacting the EPA Regional Office or State office that is in charge of preparing and implementing the 208 plan. If a facility is not located in an area with an approved 208 plan, *the facility does not require further evaluation for this part of the Surface Water Criterion.*

If a facility is located in an area with an approved 208 plan, obtain a copy of the 208 plan and determine if there are any applicable legal requirements implementing the 208 plan. This determination is best made with the assistance of the State office in charge of the 208 plan. Many of these plans do not address non-point source pollution from solid waste disposal facilities, or where such provisions are found, they are not implemented by legal requirements.

Applicable requirements under 208 are normally control methods, measures, or practices to prevent or reduce water pollution and are referred to as Best Management Practices. These might include treatment requirements, operating and maintenance procedures, and drainage from raw material storage.

Determine by office review if any legal requirements have been placed on the solid waste disposal facility. If they have, field inspection will be necessary to determine if these requirements have or have not been violated. Consultation with the appropriate 208 planning agency is recommended. If the facility does not meet its 208 requirement, *then it does not comply with this part of the Criterion.*

If no requirements implemented by law have been placed on the solid waste disposal facility, *then the facility does not require further evaluation for this Criterion.*

TABLE 3-1

STATUS OF 208 PLANS - 6/25/80

Region	State/Areawide	Certified	Approved
I	CONNECTICUT	X	X
	MAINE	X P	X P
	Greater Portland	X	X
	Southern Maine	X	X
	Northern Maine	X	X
	Androscoggin	X	X
	Southern Kennebec	X	X
	MASSACHUSETTS	X P	X P
	Berkshire County	X	X
	Cape Cod	X	X
	Martha's Vineyard	X	X
	Northern Middlesex		
	Old Colony	X	X
	Metro Boston	X	X P
	Central Mass		
	Montachusetts	X	X
	Southeast Mass	X	X
	NEW HAMPSHIRE	X P	X P
	So. Rockingham	X	X
	Lakes Region	X	X
	RHODE ISLAND	X	X
	VERMONT	X P	X P
II	NEW JERSEY	X	X
	Mercer County	X	X
	Middlesex County	X	X
	Ocean County	X	
	Cape May	X	
	Sussex County	X	
	Atlantic County	X	
	Tri-County	X	X
II	NEW YORK	X	X
	Nassau-Suffolk, LI	X	X
	Westchester	X	
	Erie-Niagara	X	
	New York City		
	Southern Tier	X	
	Central New York	X	
	VIRGIN ISLANDS		
	PUERTO RICO	X	X
	North Metro	ND	ND
III	DELAWARE	X	X
	New Castle County	X	X
	Sussex County		
	DISTRICT OF COLUMBIA	NA	NA
	Metro Wash. COG	X	X
	MARYLAND	X P	X P
	Baltimore	X	X
	PENNSYLVANIA	X P	X P
	Southwest PA		
	Delaware Valley	X	
	VIRGINIA	X P	X P
	Hampton Roads	X	
	Roanoke	X	X
	Richmond	ND	ND
	Rappahannock	X	X
	Southeast Virginia	X	X
	WEST VIRGINIA	X P	X P
	B C K P	X	X
IV	ALABAMA	X P	X P
	Birmingham	X	X
	West Alabama	X	X
	South Alabama	X	X
	FLORIDA	X	X
	Bay County	X	X
	East Central	X	X
	Volusia County	X	X
	Brevard County	X	X
	Palm Beach County	X	X
	West Florida	X	X
	Southwest Florida	X	X
	Broward County	X	X
	Tampa Bay	X	X
	Metro Dade County	X	X
	Tallahassee	X	X
	Central Florida	X	X
	GEORGIA	X	X
	Macon-Bibb	X	X
	Savannah	X	X
	Atlanta	X	X
	KENTUCKY	X	X
	Kentuckiana	X	X
	MISSISSIPPI	X	X
	Tennessee Valley	X	X
	NORTH CAROLINA	X	X
	Triangle J	X	X
	Land of Sky	X	X

(continued)

TABLE 1-1

(continued)

Region/State/Areawide	Certified	Approved
IV SOUTH CAROLINA	X	X P
Central Midlands	X	X
Appalachian	X	X
Low Country	X	X
Charleston	X	X
Waccamaw	X	X
TENNESSEE	X	X
Memphis	X	X
Knoxville	X	X
Chattanooga	X	X
Mid-Cumberland	X	X
First TN-VA	X	X
V ILLINOIS	X	X
Southeast Metro	X	X
Northeast Chicago	X	X
Greater Egypt	X	X
INDIANA		
Northwestern	X	X
Michiana	X	X
Region 6	X	X
Indiana Heartland	X	X
West Central	X	X
MICHIGAN	NA	NA
Southeastern	X	X
South Central	X	X
Region V	X	X
Region II	X	X
East Central	X	X
West Mi. Shoreline	X	X
West Michigan	X	X
Tri-County	X	X
Eastern Upper Penin.	X	X
Northwest	X	X
Northeast	X	X

Region/State/Areawide	Certified	Approved
V MICHIGAN (continued)		
Western Upper Penin.	X	X
Southwestern	X	X
Central Upper Penin.	X	X
MINNESOTA	X	X
Metro St. Paul	X	X
OHIO	X	X P
OKI-Cincinnati	X	X
Toledo	X	X
Miami Valley	X	X
Eastgate	X	X
Northeast-Akron	X	X
Northeast-Cleveland	X	X
WISCONSIN	X	X
South East	X	X
Dane County	X	X
Fox Valley	X	X
VI ARKANSAS	X	X
Metro Little Rock	X	X
Pine Bluff	X	X
Arkhoma	X	X
LOUISIANA	X	X
NEW MEXICO	X	X
OKLAHOMA	X	X
Indian Nations	X	X
Oklahoma City	X	X
TEXAS	X	X
North Central	X	X
Southeast	X	X
Houston-Galveston	X	X
Alamo Area	X	X
Coastal Bend	X	X
Lower Rio Grande	X	X

Region/State/Areawide	Certified	Approved
TEXAS (continued)		
Texarkana	X	X
Central Texas	X	X
VII IOWA	X	X
Des Moines	X	X
Chariton Valley	ID	ID
KANSAS	X	X
Mid-America	X	X
MISSOURI	X	X
East-West Gateway	X	X
Ozark Gateway	ID	ID
NEBRASKA	X	X
VIII COLORADO	X	X
Pikes Peak	X	X
Pueblo	X	X
Denver	X	X
Colorado West		
Northwest Colorado	X	
Larimer Weld	X	X
MONTANA	X	X
Mid-Yellowstone	ID	ID
Flathead	X	X
Yellowstone-Tongue	X	X
Blue Ribbons	X	X
NORTH DAKOTA	X	X
Lewis & Clark	X	X
SOUTH DAKOTA	X	X
Sixth District	X	X
Southeastern	X	X

(continued)

TABLE 3-1
(continued)

Region/State/Areawide		Certified	Approved
VIII	UTAH	X P	X P
	Mountainland	X	X
	Uintah Basin	X	X
	Salt Lake County	X	X
	Weber River	X	X
	Southeastern	X	X
	Five County	X	X
	WYOMING	X	
	Powder River	X	
	Southwest	X	
	Teton County	X	
IX	ARIZONA	NA	NA
	Pima	X	X
	Central Arizona	X	X
	District #4	X	X
	Southeastern	X	X
	Northern	X	X
	Maricopa County	X	X
	CALIFORNIA	X	X
	Ventura	X	X
	Monterey Bay	X	X
	San Diego	X	X
	San Francisco (ABAG)	X	X
	Southern Calif.	X	X
	Sacramento	X	X
	Tahoe		
	HAWAII	X	X
	NEVADA	X	X
	Washoe	X	X
	Carson County	X	
	Clark County	X	X
IX	TRUST TERRITORIES	X	
	GUAM	X	X
X	ALASKA	X	X
	Anchorage	X	X
	IDAHO	X	X
	Southeast	X	X
	Ada	X	X
	Panhandle	X	X
	OREGON	X	X
	Columbia	X	X
	Mid-Willamette	X	X
	Lane	X	X
	Rogue Valley	X	X
	Snohomish	X	X
	WASHINGTON	X P	X P
	Clark County	X	X
	Seattle	X	X

CHAPTER 3

SURFACE WATER

Criterion Compliance Decision

☐ *Does Not Require Further Evaluation*

☐ *Does Not Comply*

1. Is there a point source discharge of pollutants to waters of the United States?

☐ YES (continue to 2)

- ☐ Facility has a Section 402 (NPDES) permit
- ☐ Landfill with a discharge from a leachate collection system
- ☐ Landfill with a discharge from an on-site leachate treatment system
- ☐ Landfill with a direct discharge of solid waste or leachate into waters of the United States
- ☐ Surface impoundment with a discharge from a pipe or outfall
- ☐ Surface impoundment with a discharge from an eroded channel
- ☐ Surface impoundment with a discharge from a spillway structure
- ☐ Surface impoundment located in waters of the United States
- ☐ Landspreading operations with a discharge from an outfall pipe, or channel that drains the landspreading area where the waste is not incorporated into the soil
- ☐ Landspreading operations located in waters of the United States where waste is not applied for enhancement of vegetative growth

☐ NO (continue to 4)

2. Does the facility have a 404 permit and does it satisfy the terms of the permit?

☐ YES (continue to 3)

- ☐ Facility operates in compliance with its 404 permit
- ☐ Facility has applied for a 404 permit

☐ NO (*DOES NOT COMPLY* - continue to 3)

- ☐ Facility has a 404 permit, but is in violation of that permit
- ☐ Facility has not applied for a 404 permit

3. Does the facility have a 402 permit and does it satisfy the terms of the permit?

   ☐ YES (continue to 4)

   - ☐ Facility operates according to 402 permit requirements
   - ☐ Facility has applied for a 402 permit

   ☐ NO (*DOES NOT COMPLY* - continue to 4)

   - ☐ Facility has a 402 permit, but is in violation of the permit
   - ☐ Facility has not applied for a 402 permit

4. Is there a non-point source discharge from the facility?

   ☐ YES (continue to 5)

   - ☐ Surface impoundment with spillover, overtopping, or leakage
   - ☐ Other ____________________

   ☐ NO (*DOES NOT REQUIRE FURTHER EVALUATION*)

5. Does the facility cause non-point source polluting of the waters of the United States that violates applicable legal requirements implementing an area-wide or State-wide water quality management plan that has been developed and approved by the Administrator under Section 208 of the Clean Water Act, as amended?

   ☐ YES (*DOES NOT COMPLY*)

   ☐ NO (*DOES NOT REQUIRE FURTHER EVALUATION*)

   - ☐ Facility not in an area with an approved 208 plan
   - ☐ Facility in an area with an approved 208 plan and complies with all applicable requirements
   - ☐ No 208 requirements have been placed on the facility

CHAPTER 4

GROUND WATER

1.0 Criterion and Definitions

§ 257.3–4 Ground Water.

(a) A facility or practice shall not contaminate an underground drinking water source beyond the solid waste boundary or beyond an alternative boundary specified in accordance with paragraph (b) of this section.

(b) Only a State with a solid waste management plan approved by the Administrator pursuant to Section 4007 of the Act may establish an alternative boundary to be used in lieu of the solid waste boundary. A State may specify such a boundary only if it finds that such a change would not result in contamination of ground water which may be needed or used for human consumption. This finding shall be based on analysis and consideration of all of the following factors:

(1) The hydrogeological characteristics of the facility and surrounding land;

(2) The volume and physical and chemical characteristics of the leachate;

(3) The quantity, quality, and directions of flow of ground water;

(4) The proximity and withdrawal rates of ground-water users;

(5) The availability of alternative drinking water supplies;

(6) The existing quality of the ground water including other sources of contamination and their cumulative impacts on the ground water; and

(7) Public health, safety, and welfare effects.

(c) As used in this section:

(1) "Aquifer" means a geologic formation, group of formations, or portion of a formation capable of yielding usable quantities of ground water to wells or springs.

(2) "Contaminate" means introduce a substance that would cause:

(i) The concentration of that substance in the ground water to exceed the maximum contaminant level specified in Appendix I, or

(ii) An increase in the concentration of that substance in the ground water where the existing concentration of that substance exceeds the maximum contaminant level specified in Appendix I.

(3) "Ground water" means water below the land surface in the zone of saturation.

(4) "Underground drinking water source" means:

(i) An aquifer supplying drinking water for human consumption, or

(ii) An aquifer in which the ground water contains less than 10,000 mg/1 total dissolved solids.

(5) "Solid waste boundary" means the outermost perimeter of the solid waste (projected in the horizontal plane) as it would exist at completion of the disposal activity.

Appendix I

The maximum contaminant levels promulgated herein are for use in determining whether solid waste disposal activities comply with the ground-water criteria (§ 257.3–4). Analytical methods for these contaminants may be found in 40 CFR Part 141 which should be consulted in its entirety.

1. *Maximum contaminant levels for inorganic chemicals.* The following are the maximum levels of inorganic chemicals other than fluoride:

Contaminant	Level (milligrams per liter)
Arsenic	0.05
Barium	1.
Cadmium	0.010
Chromium	0.05
Lead	0.05
Mercury	0.002
Nitrate (as N)	10.
Selenium	0.01
Silver	0.05

The maximum contaminant levels for fluoride are:

Temperature[1] degrees Fahrenheit	Degrees Celsius	Level (milligrams per liter)
53.7 and below	12 and below	2.4
53.8 to 58.3	12.1 to 14.6	2.2
58.4 to 63.8	14.7 to 17.6	2.0
63.9 to 70.6	17.7 to 21.4	1.8
70.7 to 79.2	21.5 to 26.2	1.6
79.3 to 90.5	26.3 to 32.5	1.4

[1] Annual average of the maximum daily air temperature.

2. *Maximum contaminant levels for organic chemicals.* The following are the maximum contaminant levels for organic chemicals:

	Level (milligrams per liter)
(a) Chlorinated hydrocarbons:	
Endrin (1,2,3,4,10,10-Hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-1,4-endo, endo-5,8-dimethano naphthalene)	0.0002
Lindane (1,2,3,4,5,6-Hexachlorocyclohexane, gamma isomer	0.004
Methoxychlor (1,1,1-Trichloro-2,2-bis (p-methoxyphenyl) ethane)	0.1
Toxaphene ($C_{10}H_{10}Cl_8$-Technical chlorinated camphene, 67 to 69 percent chlorine)	0.005
(b) Chlorophenoxys:	
2,4-D (2,4-Dichlorophenoxy-acetic acid)	0.1
2,4,5-TP Silvex (2,4,5-Trichlorophenoxypropionic acid)	0.01

3. *Maximum microbiological contaminant levels.* The maximum contaminant level for coliform bacteria from any one well is as follows:

(a) using the membrane filter technique:

(1) Four coliform bacteria per 100 milliliters if one sample is taken, or

(2) Four coliform bacteria per 100 milliliters in more than one sample of all the samples analyzed in one month.

(b) Using the five tube most probable number procedure, (the fermentation tube method) in accordance with the analytical recommendations set forth in "Standard Methods for Examination of Water and Waste Water", American Public Health Association, 13th Ed. pp. 662–688, and using a Standard sample, each portion being one fifth of the sample:

(1) If the standard portion is 10 milliliters, coliform in any five consecutive samples from a well shall not be present in three or more of the 25 portions, or

(2) If the standard portion is 100 milliliters, coliform in any five consecutive samples from a well shall not be present in five portions in any of five samples or in more than fifteen of the 25 portions.

4. *Maximum contaminant levels for radium-226, radium-228, and gross alpha particle radioactivity.* The following are the maximum contaminant levels for radium-226, radium-228, and gross alpha particle radioactivity:

(a) Combined radium-226 and radium-228—5 pCi/l;

(b) Gross alpha particle activity (including radium-226 but excluding radon and uranium)—15 pCi/l.

Proposed Amendment

5. *Maximum contaminant levels for other than health effects.*

The following are the maximum levels for odor, taste and miscellaneous contaminants:

Contaminant	Level
Chloride	250 mg/l.
Color	15 Color units.
Copper	1 mg/l.
Foaming agents	0.5 mg/l.
Iron	0.3 mg/l.
Manganese	0.05 mg/l.
Odor	3 Threshold odor No.
pH	6.5–8.5.
Sulfate	250 mg/l.
TDS	500 mg/l.
Zinc	5 mg/l.

2.0 Inventory Procedure

For the purpose of the Inventory, facility non-compliance will be based on the results of monitoring for contamination. Since the time involved precludes immediate monitoring of all facilities, the procedure includes the ranking of facilities according to their contamination potential so that a monitoring priority can be assigned. The process consists of:

(a) Elimination from further consideration of those facilities at which the ground water is not being used as a human drinking water source and contains more than 10,000 mg/l TDS.

(b) Ranking of the remaining facilities based on their contamination potential, considering the type of facility, hydrogeologic conditions, and operating procedures.

(c) Determination of non-compliance based on monitoring to detect actual contamination. Non-compliance decisions are only based on the numerical limits specified in Appendix I, Sections 1-4, and not on the proposed levels in Section 5 of the Criterion.

The decision flow chart is presented in Figure 4-1.

3.0 Resolution of Decision Flow Chart Questions

3.1 Is ground water not being used as a human drinking water source and does it contain more than 10,000 mg/l TDS?

The ground water in question is that most likely to be contaminated by the facility, generally the shallowest water-bearing geologic formation. If this ground water is being used for a human drinking water supply in the vicinity of the facility, then the facility needs to be evaluated regardless of the TDS concentration. If there is no usage of the ground water, and the natural or background concentration of TDS is expected to be greater than 10,000 mg/l, existing ground-water data and reports should be consulted to confirm the concentrations. If the high TDS concentration is due to contamination from sources other than the facility in question, and the original or natural TDS level was less than 10,000 mg/l, the facility may not be eliminated from further consideration.

Sources of information on ground-water quality that might be useful in determining the TDS concentration in the area include:

- U.S.G.S. "Water Resources Investigations" reports for the area.
- State water, natural resources, or geologic survey reports.
- City or county health agency or water agency.
- Local drilling contractors' records.
- Records of drilling from site permit data.

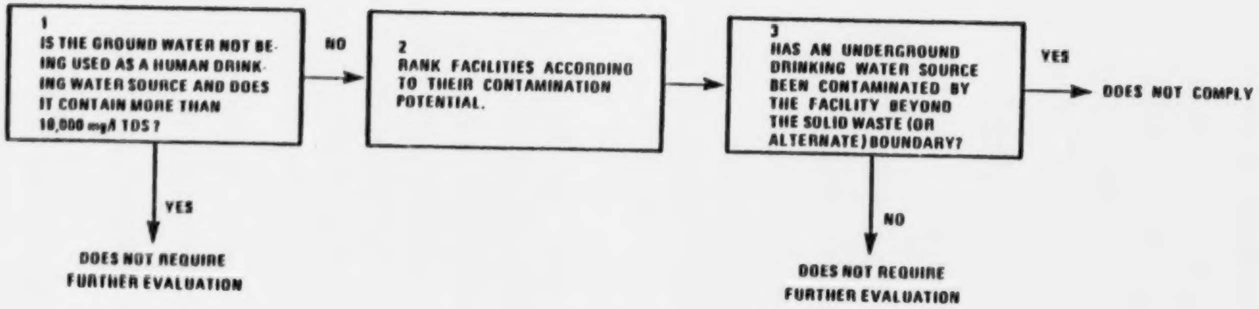

1
IS THE GROUND WATER NOT BEING USED AS A HUMAN DRINKING WATER SOURCE AND DOES IT CONTAIN MORE THAN 10,000 mg/l TDS ?
NO
YES
DOES NOT REQUIRE FURTHER EVALUATION
2
RANK FACILITIES ACCORDING TO THEIR CONTAMINATION POTENTIAL.
3
HAS AN UNDERGROUND DRINKING WATER SOURCE BEEN CONTAMINATED BY THE FACILITY BEYOND THE SOLID WASTE (OR ALTERNATE) BOUNDARY?
YES
DOES NOT COMPLY
NO
DOES NOT REQUIRE FURTHER EVALUATION

FIGURE 4.1 FLOW CHART – GROUND WATER

If not available from the above sources, TDS concentrations may be determined by testing the ground water. Samples should be drawn from the nearest existing well(s), if any , pumping from the ground-water source of concern. If there are no wells available nor any information on the TDS concentration, assume the level is less than 10,000 mg/l and continue to the next section (3.2).

Where multiple aquifers are present, such as shown in Figure 4-2, facilities may be eliminated from further consideration if the ground water most likely to be contaminated (1) has a natural TDS concentration of greater than 10,000 mg/l, and (2) is separated from usable ground water (<10,000 mg/l) by a geologic formation, such as an aquiclude, that is capable of preventing leakage of contaminated water into the usable aquifer. Marked differences in TDS concentrations (e.g., 10,000 vs. 1,000) between the two aquifers may be sufficient evidence of the aquiclude's capability to prevent leakage.

In summary:

(1) If the ground water is being used as a human drinking water source or contains less than 10,000 mg/l TDS, continue to Section 3.2.

(2) If the ground water is not being used as a human drinking water source and contains more than 10,000 mg/l TDS, *then the facility may be eliminated from further consideration under this Criterion.*

3.2 Rank Facilities According to their Contamination Potential

To determine non-compliance for those facilities remaining after the elimination step, monitoring and ground-water analysis is necessary because the Criterion specifies numerical limits (maximum contaminant levels, Appendix I - Sections 1-4) that may not be exceeded. This section discusses monitoring priorities based on hydrogeologic conditions, operating procedures, and facility type.

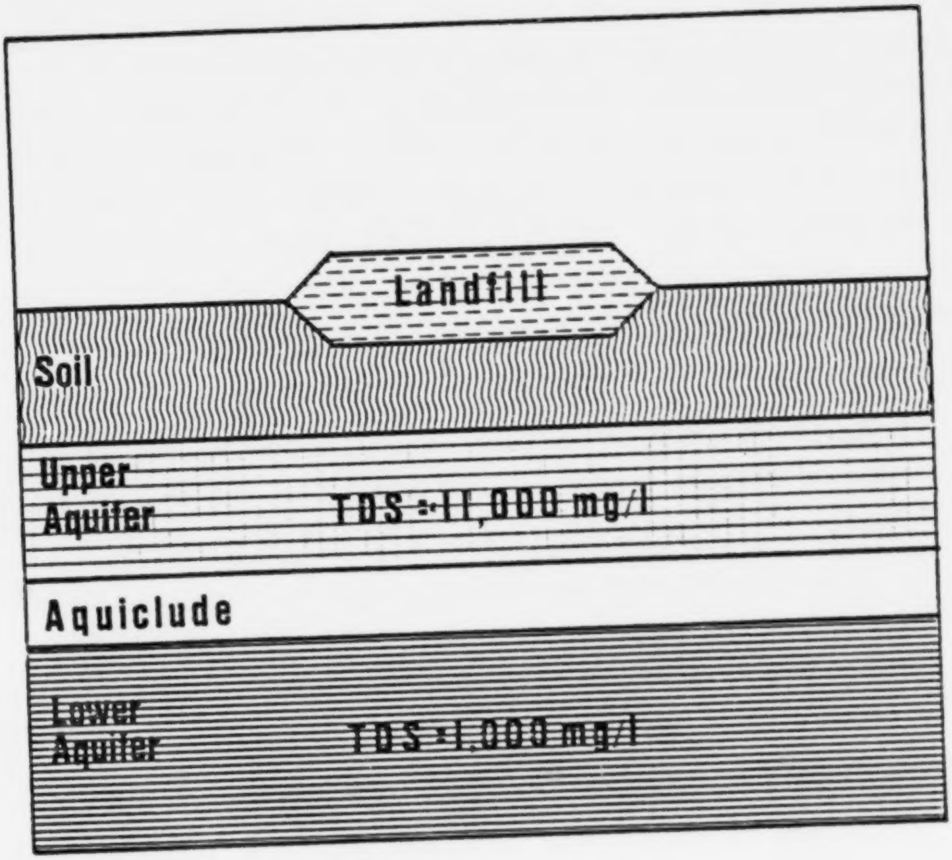

Landfill
Soil
Upper Aquifer
TDS = 11,000 mg/l
Aquiclude
Lower Aquifer
TDS = 1,000 mg/l

FIGURE 4-2 MULTIPLE AQUIFERS

3.2.1 Ranking of Facilities in the Recharge Zone of Sole Source Aquifers[1]

Top priority for monitoring should be assigned to those facilities located in recharge areas of aquifers which have been designated by EPA as "sole source aquifers." The eight sole source aquifers designated to date by EPA are described in the following issues of the Federal Register.

(1) Edwards Underground Reservoir, San Antonio, Texas; FR 12-16-75, Vol. 40, No. 242.
(2) Ratheman Valley, Spokane, Washington; FR 2-9-78, Vol. 43, No. 28.
(3) Northern Island of Guam; FR 4-26-78, Vol. 43, No. 81.
(4) Nassau and Suffolk Counties, New York; FR 6-21-78, Vol. 43, No. 120.
(5) Fresno County, California; FR 9-10-79, Vol. 44, No. 176.
(6) Ten Mile Creek Sole Source Aquifer, Montgomery, Frederick, Howard, and Carroll Counties, Maryland; FR 8-27-80, Vol. 45, No. 168.
(7) Biscayne Aquifer, Southeast Florida; FR 10-11-79, Vol. 44, No. 198.
(8) Buried Valley of Passaic River Basin, New Jersey; FR 3-29-79, Vol. 44, No. 62.

If the facility is located in a recharge area of one of these aquifers, the facility should be given top priority for monitoring.

3.2.2 Ranking of Landfills Not Located in Recharge Zones of Sole Source Aquifers

The ranking procedure for landfills not located in the recharge zone of a sole source aquifer is based on aquifer and unsaturated zone characteristics. The procedure was developed from documented landfill case studies and the Surface Impoundment Assessment[2] technique, and is intended to assign the highest priority to those facilities most likely to contaminate ground water. This hydrogeologic monitoring priority may be modified to some extent by consideration of certain site-specific characteristics.

The ranking procedure requires the input of three values that describe the facility hydrogeologic setting (Figure 4-3). Methods for estimating these values are as follows:

(1) Unsaturated zone thickness, meters.

(a) For uniform soils, use the minimum distance from the bottom of the landfill to the seasonal high level of the ground water in an unconfined aquifer, or to the top of a confined aquifer, whichever is shallowest. Perched aquifers should also be considered if they are capable of supplying usable quantities of water.

(b) Neglect the thickness of any highly fractured rock layers.

(c) For layered series of soils or rock having similar hydrologic properties (permeability), use the entire thickness.

(d) For equally thick layers of soils or rock having dissimilar hydrologic properties (greater than two orders of magnitude permeability difference), use only the thickness of the least permeable layer. This layer must be continuous under the entire facility and at least 1 meter thick. Otherwise, utilize only the thickness of the more permeable strata.

(e) For layers of soils or rock with different thickness and hydrologic properties, two options are available. Either use the thickness of the layer with the least permeability, or use the total combined thickness with a weighted permeability [calculated in the next step, 3.2.2(2)].

(2) Unsaturated zone permeability, cm/sec.

(a) For the uniform soil or rock thickness selected in (1), select an appropriate permeability from Table 4-1.

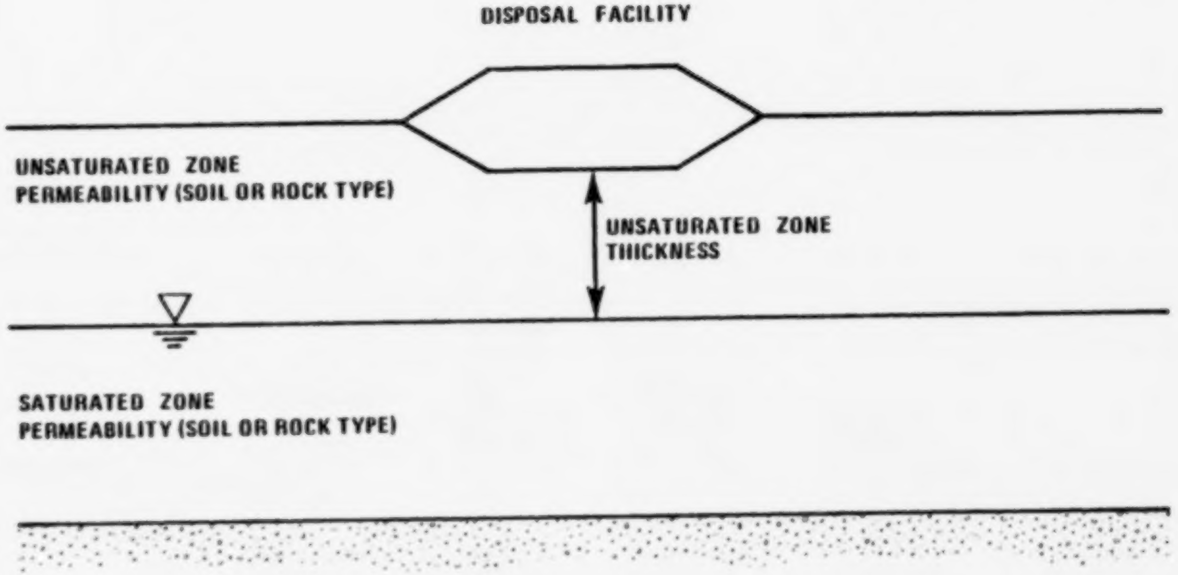

DISPOSAL FACILITY
UNSATURATED ZONE PERMEABILITY (SOIL OR ROCK TYPE)
UNSATURATED ZONE THICKNESS
SATURATED ZONE PERMEABILITY (SOIL OR ROCK TYPE)

FIGURE 4-3 VARIABLES FOR RANKING

TABLE 4-1

REPRESENTATIVE PERMEABILITIES OF EARTH MATERIALS

Soil Type:	Gravel, coarse to medium sand	Fine to very fine sand	Clayey sand, coarse to medium silt	Fine silt, clayey silt	Sandy clay, silty clay	Clay
Rock Type:	Limestone (fractured cavernous) Evaporites Basalt Lava	Fractured igneous and metamorphic rock Poorly cemented sandstone	Moderately cemented sandstone Fractured shale	Well-cemented sandstone Mudstone	Siltstone	Unfractured shale, igneous and metamorphic rock
Representative Permeability (cm/sec)	$10^{1} - 10^{-3}$	$10^{-3} - 10^{-4}$	$10^{-4} - 10^{-5}$	$10^{-5} - 10^{-6}$	$10^{-6} - 10^{-7}$	$10^{-7} - 10^{-8}$

(b) If the permeability is available from existing permit or site investigation data, use that value rather than Table 4-1.

(c) For multi-layered sequences with similar hydrologic properties (less than two orders of magnitude permeability difference) for which the entire thickness was selected, an average or permeability range may be estimated or a permeability may be calculated. The following equation is suggested for permeability calculations. This equation emphasizes the contribution to attenuation of less permeable layers.

$$K_w = \frac{T_1 + T_2 + T_3 + \ldots T_n}{T_1/K_1 + T_2/K_2 + T_3/K_3 + \ldots T_n/K_n}$$

where T = thickness of each layer in meters
K = permeability of each layer in cm/sec

(3) Saturated zone permeability, cm/sec

(a) If the permeability is available from other information sources such as ground-water reports or permit data, utilize that value rather than Table 4-1.

(b) For a uniform soil or rock aquifer, select the permeability from Table 4-1.

(c) For layered sequences of soil or rock, select the appropriate permeability from Table 4-1 for the uppermost saturated layer. If the upper layer is less permeable than an underlying stratum and is less than 1 meter in thickness, select the permeability from Table 4-1 for the underlying layer.

The facility's ranking (monitoring priority) is obtained from Table 4-2 utilizing the above three values. When a site has multiple priorities based on varying hydrogeologic conditions, select the highest of the rankings. If the information needed

TABLE 4-2

MONITORING PRIORITY

Saturated Zone Permeability (cm/sec)	Unsaturated Zone Thickness (m)	Unsaturated Zone Permeability (cm/sec)	Monitoring Priority
$>10^{-4}$	<1	NA*	High
	1-10	$>10^{-4}$	High
		$10^{-4} - 10^{-6}$	Medium
		$<10^{-6}$	Low
	>10	$>10^{-2}$	High
		$10^{-2} - 10^{-4}$	Medium
		$<10^{-4}$	Low
$10^{-4} - 10^{-6}$	<1	NA	High
	1-3	$>10^{-4}$	High
		$10^{-4} - 10^{-6}$	Medium
		$<10^{-6}$	Low
	3-10	$>10^{-2}$	High
		$10^{-2} - 10^{-6}$	Medium
		$<10^{-6}$	Low
	>10	$>10^{-4}$	Medium
		$<10^{-4}$	Low
$<10^{-6}$	<1	NA	High
	1-3	$>10^{-6}$	Medium
		$<10^{-6}$	Low
	>3	$>10^{-4}$	Medium
		$<10^{-4}$	Low

* NA - Not applicable.

to obtain the values for the hydrogeologic description and ranking is not available from facility or permit information, then the ranking may be based on the geologic setting of the facility or on information such as nearby well logs, SCS soils maps, geologic maps, or field investigation of facility excavations. Borings, permeability tests, and laboratory soil classification are not considered necessary since the procedure is only for the assignment of a monitoring priority.

(4) Modification to the ranking.

After considering the above factors, the investigator may choose to modify or fine-tune the monitoring priority slightly, considering certain site-specific characteristics. These modifiers can also be used to order the priority among a number of facilities with the same hydrogeologic priority. The characteristics are described below in (5). If a change in priority is deemed appropriate, the following guidance should be observed:

(a) The modification may be used to move a facility from a high monitoring priority to a medium monitoring priority, or vice versa.

(b) The modifications should rarely be used to move a facility from a medium monitoring priority to a low monitoring priority.

(5) Site specific characteristics.

(a) Initial quality/quantity (specific yield) and use of ground water in the vicinity of the facility.

Ground water near the facility may be used for human consumption; used for other purposes; or not currently used. Facilities overlying ground water that is currently used as drinking water, that are close to drinking water wells, or that are immediately overlying a high yield formation should be given a higher priority.

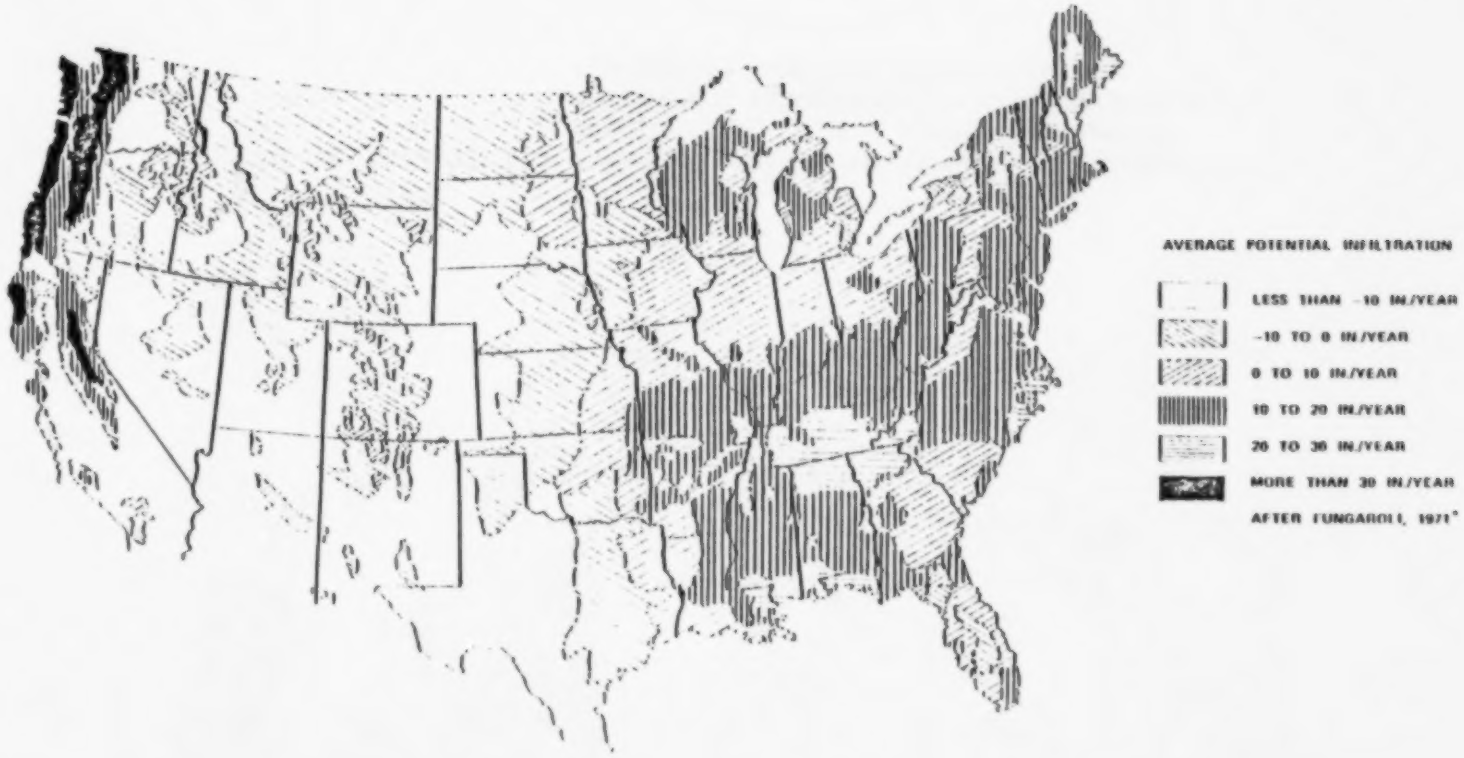
(b) Infiltration.

The quantity of leachate generated is dependent on the amount of infiltration through the waste mass. While the relative impact on ground-water quality is difficult to accurately predict based on leachate quantity, in general it may be assumed that facilities with greater infiltration should have higher priorities. In arid areas of the United States where there is virtually no recharge to ground water, where leachate is not likely to be produced due to infiltration, and where no liquids are added from other sources, all but those landfills where the waste is within 1 meter of ground water may be assigned a lower priority. General estimates of infiltration can be obtained using Figure 4-4. High net infiltration areas should be assigned a higher priority. Judgment should be based on local conditions, especially in dry areas where average annual potential infiltration may be less than zero, but where on a daily or monthly basis, infiltration and leachate production may occur. The investigator is cautioned against greatly modifying the monitoring priority with this factor, since even a small amount of leachate can have an impact on ground-water quality.

In arid areas, where leachate is not likely to be produced in as significant quantities from landfills or landspreading sites as at surface impoundments, an overall higher monitoring priority should be considered for surface impoundments.

(c) Liners and leachate collection systems.

Facilities that have taken measures to prevent and control leachate migration through the use of soil or synthetic liners and/or leachate collection usually constitute less of a contamination potential than facilities without these measures. There might be concern if the


AVERAGE POTENTIAL INFILTRATION
LESS THAN -10 IN./YEAR
-10 TO 0 IN./YEAR
0 TO 10 IN./YEAR
10 TO 20 IN./YEAR
20 TO 30 IN./YEAR
MORE THAN 30 IN./YEAR
AFTER FUNGAROLI, 1971*

*POLLUTION OF SUBSURFACE WATER BY SANITARY LANDFILLS,
V.I. A.A. FUNGAROLI. ENVIRONMENTAL PROTECTION PUBLICA
TION SW 12 RG. WASHINGTON, D.C., U.S., GOVERNMENT PRINTING
OFFICE, 1971 [200 p.]

FIGURE 4.4 GENERAL ESTIMATES OF INFILTRATION

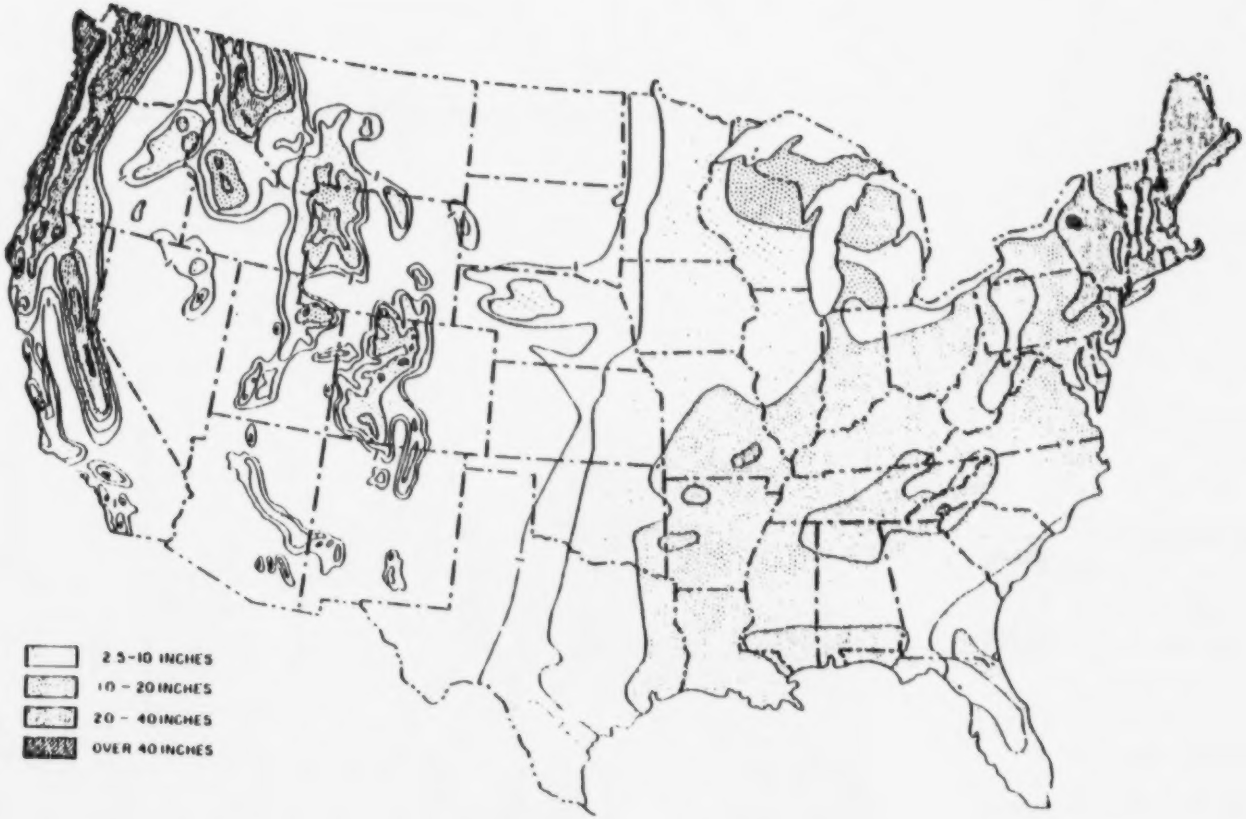

2.5-10 INCHES
10 - 20 INCHES
20 - 40 INCHES
OVER 40 INCHES

FIGURE 4-4 (CONTINUED) AVERAGE ANNUAL RUNOFF IN THE UNITED STATES
SOURCE: CHOW, V. T. (ED.) HANDBOOK OF APPLIED HYDROLOGY: A COMPENDIUM OF WATER RESOURCES TECHNOLOGY. NEW YORK, McGRAW-HILL, 1964.

liners leak. Adjustment of priorities where liners and collection systems are installed will have to be based on experience with the particular facility.

(d) Karst terrain.

Karst areas are characterized by solution channels and fractured limestone. Contaminants may reach the water table relatively undiluted, and may travel quickly to other areas. For this reason, facilities located in karst terrain with shallow soils, pinnacle bedrock, or known solution activity should have a slightly higher monitoring priority even in situations where the water table is very deep.

(e) Floodplains.

Modification of ranking of facilities located in a floodplain is site specific. In some instances, the facility may be in a ground-water discharge area with a limited areal potential for contamination; therefore, it should be assigned a lower priority. In other cases, the hydrogeology may be complex and there may be additional infiltration due to flood waters; as a result, a higher monitoring priority should be assigned to the facility. Other facilities may have some form of flood protection, or they may be designed to control ground-water discharge. The investigator must consider the pros and cons of a facility located in a floodplain and determine if it should be assigned a higher or lower monitoring priority.

(f) Operational quality.

If the facility is operating under a State permit, then the investigator should determine if all the conditions relative to ground-water protection specified in the permit are being met in the daily operation of the facility. If they are not, it may be appropriate to assign a higher monitoring priority than sites handling only municipal and commercial refuse.

(h) Other factors.

Additional modification may be given for such factors as site age, water balance predictions, attenuation and dilution prediction, confidence in the data available, site size, aquifer size, and the downgradient distance from the solid waste to the solid waste boundary. The results of a rigorously conducted earth resistivity survey may also be useful in ranking. Depths to ground water in excess of the unsaturated zone thicknesses of Table 4-2 may also be included as an additional modifier for priority adjustment.

3.2.3 Ranking of Surface Impoundments Not Located in the Recharge Zone of a Sole Source Aquifer

The ranking procedure for surface impoundments is based on the Surface Impoundment Assessment (SIA) System now in use by the EPA. The procedure considers hydrogeologic characteristics and assigns a rating for each of several parameters. The ratings are then entered into a table, and a monitoring priority is read from the table.

Following the instructions in A Manual for Evaluating Contamination Potential of Surface Impoundments, complete Steps 1 and 2 for rating the unsaturated and saturated zones at the facility location. Using these values, enter Table 4-3 to find the monitoring priority. The data necessary for completing these steps may already be available from another State agency or the EPA Office of Drinking Water, if the Surface Impoundment Assessment is being done or has been completed for the facility. Information developed during the Surface Impoundment Assessment may be obtained from a computerized data base being maintained by the EPA Office of Drinking Water. Requests for information should be directed through the State Agency responsible for the surface impoundment, or the appropriate EPA Regional Office.

The monitoring priority may be modified to some extent by site-specific characteristics. Applicable ranking guidance contained in Section 3.2.2 should be used to modify the ranking of surface impoundments.

TABLE 4-3

MONITORING PRIORITY* - SURFACE IMPOUNDMENTS

Saturated Zone Rating	Unsaturated Zone Rating	Monitoring Priority
6A,6A, 3A	9A-9K, 6B, 7B, 8B, 7C, 5D	High
	6C, 4D, 3E, 1F	Medium
	All others	Low
4C, 3C, 1C	9C-9K, 8B, 9A, 9B, 7B, 7C	High
	6C, 6B, 5D, 4D	Medium
	All others	Low
2E, 1E, 0E	9E-9K, 9A-9D, 8B, 7B, 6B	High
	7C, 5D	Medium
	All others	Low

*Based on moderate waste hazard potential (4-7 range).

Liquid depth and base linings are of concern in estimating infiltration rather than a precipitation-evapotranspiration water balance. Waste type should be taken into account as explained in Step 4 of the SIA Manual, rather than as discussed for landfills. Table 4-3 is based on moderate (4-7) waste hazard potential ratings. Therefore, facilities handling wastes with higher waste hazard potentials (8-9) should be given a higher priority, and those wastes with lesser ratings (1-3) could be given a lower priority.

3.2.4 Ranking of Landspreading Facilities

Most landspreading facilities are not considered to constitute a serious ground-water pollution problem, although contamination has been known to occur. These facilities should be ranked as follows:

(a) For disposal facilities which handle sewage sludge only, and which apply sludge at rates greater than the crop or vegetative nitrogen demand (see 3.2.5), use Section 3.2.2 and Table 4-2 to determine a priority.

(b) For facilities handling wastes other than sewage sludge, and which contain concentrations of any metal or organic constituent in excess of those listed in the Criterion, Appendix I, Sections 1-4 (see 3.2.6), also use Section 3.2.2 and Table 4-2 to determine a priority.

(c) All other landspreading facilities should be given a low priority for monitoring.

3.2.5 Guidance for Ranking of Landspreading Facilities Handling Sewage Sludge

To determine whether the sludge nitrogen (N) is being applied in excess of crop or vegetative demand, it is preferable to have an analysis of NH_4-N content and organic nitrogen content of the sludge. Where this is not available for aerobically or anaerobically digested sludge, the following average values for pounds of available nitrogen per ton of dry sludge applied may be substituted for [(B) + (C)] in the calculation below. For other sludges, average representative values are not available, and sludge analyses are necessary.

	lb N available/ ton of dry sludge
where sludge is surface applied:	
anaerobically digested	21
aerobically digested	13
other - calculate	
where sludge is incorporated into the soil:	
anaerobically digested	37
aerobically digested	17
other - calculate	

Calculations:

- Obtain the crop N requirement from Table 4-4. (A)
- Calculate the available N in the sludge by (1) or (2), below.
  - (1) where sludge is incorporated into the soil:
    percent NH_4-N in sludge x 20 = lb NH_4-N/ton of sludge (B)
  - (2) where sludge is surface applied:
    percent NH_4-N in sludge x 10 = lb NH_4-N/ton of sludge (B)
- Percent organic-N x 2 = lb organic-N/ton of sludge (C)
- Calculate the sludge application rate necessary for crop demand:

$$\text{Rate (tons/acre)} = \frac{(A)}{(B) + (C)^{*}}$$

If the current sludge application rate is greater than the nitrogen demand rate calculated above, the facility should be assigned a priority from Section 3.2.2 and Table 4-2. Otherwise, a low monitoring priority may be assumed.

---

* Note: Residual nitrogen has been deleted from the calculation and may be included, if desired.

TABLE 4-4

ANNUAL NITROGEN (N) DEMANDS OF CROPS*

Crop	Yield/acre	N (lb/acre)
Corn	150 bu	185
Corn silage	32 tons	200
Soybeans	50 bu	257**
Grain sorghum	4 tons	250
Wheat	60 bu	125
Oats	100 bu	150
Barley	100 bu	150
Alfalfa	8 tons	450**
Orchard grass	6 tons	300
Brome grass	5 tons	166
Tall fescue	3.5 tons	135
Bluegrass	3 tons	200

* Values reported are from reports by the Potash Institute of America and are for the total above-ground portion of the plants. For the purpose of estimating nutrient requirements for any particular crop year, complete crop removal can be assumed. Where crop yields are less, reduce the nitrogen demand by the ratio of the reduced yield to that listed in the table.

** Legumes obtain N from symbiotic N_2 fixation so fertilizer N is not necessary.

3.2.6 Guidance for Ranking of Landspreading Facilities Handling Other Waste

Landspreading facilities that dispose of other wastes will be ranked using Table 4-2. "Other wastes" here means wastes or sludges that contain concentrations of any metal or organic constituent in excess of those listed in the Criterion, Appendix I, Section 1-4. Facilities that accept such waste usually receive an analysis of the sludge from which the metals and organic content may be determined. If no such analysis is available, the investigator should obtain a representative sample of the sludge and have it analyzed for those parameters listed in Appendix I.

If the concentrations of metals or organics are in excess of those listed in the Criterion, Appendix I, assign the facility a monitoring priority based on Section 3.2.2 and Table 4-2. If concentrations are not exceeded, assign the facility a low priority.

3.3 Has an underground drinking water source been contaminated by the facility beyond the solid waste (or alternate) boundary?

Monitoring is required to determine non-compliance because the Criterion limits concentration changes of certain ground-water constituents to specific values, and only through monitoring can a facility be determined to have impacted an underground drinking water source in excess of these values. Reference should be made to Procedures Manual for Ground-Water Monitoring at Solid Waste Disposal Facilities[3] for guidance on evaluation of existing monitoring systems, and on design and installation of new monitoring systems.

Facilities that receive a high monitoring priority in the previous section (3.2) should be monitored first, followed by medium priority facilities. Low priority facilities should be monitored after all other facilities have been evaluated. The monitoring wells should be placed to detect contamination (i.e., an exceeding of the MCLs) beyond the solid waste boundary, unless an alternate boundary has been specified by the State in accordance with the Criterion (see 40 CFR 257). If no alternate boundary has been specified, the solid waste boundary is to be used. In the case of a facility which does not have a permit/plan designating the ultimate limits (boundary) of the solid waste to be deposited, the solid waste boundary should be taken as the edge of the waste at the time of the Inventory evaluation.

3.3.1 Evaluating Existing Monitoring Systems

If the facility has an adequate existing monitoring system that is correctly placed with respect to the solid waste or alternate boundary, this system may be used for the purpose of the Inventory.

The adequacy of the existing monitoring system must be evaluated, preferably by or with the assistance of a hydrogeologist. The system should yield representative samples of ground water and detect contamination in underground drinking water sources (usually the uppermost aquifer) beyond the appropriate boundary. To evaluate a system, obtain drilling logs for each well, a map of the site showing well locations, and information on the geologic character of the site. Consider these factors:

(a) Number and location of wells.

The system should have at a minimum one well hydraulically upgradient from the site and at least two wells downgradient. The downgradient wells should be located as close as is practicable to the solid waste (or alternate) boundary without being drilled through the waste. The upgradient well(s) should not be within the area influenced by a ground-water mound.[4,5] Well screen depth and length should encounter the contaminant plume, as influenced by gradient, soil or rock type, and distance from the waste deposit to the well. Examples are included in Reference No. 3.

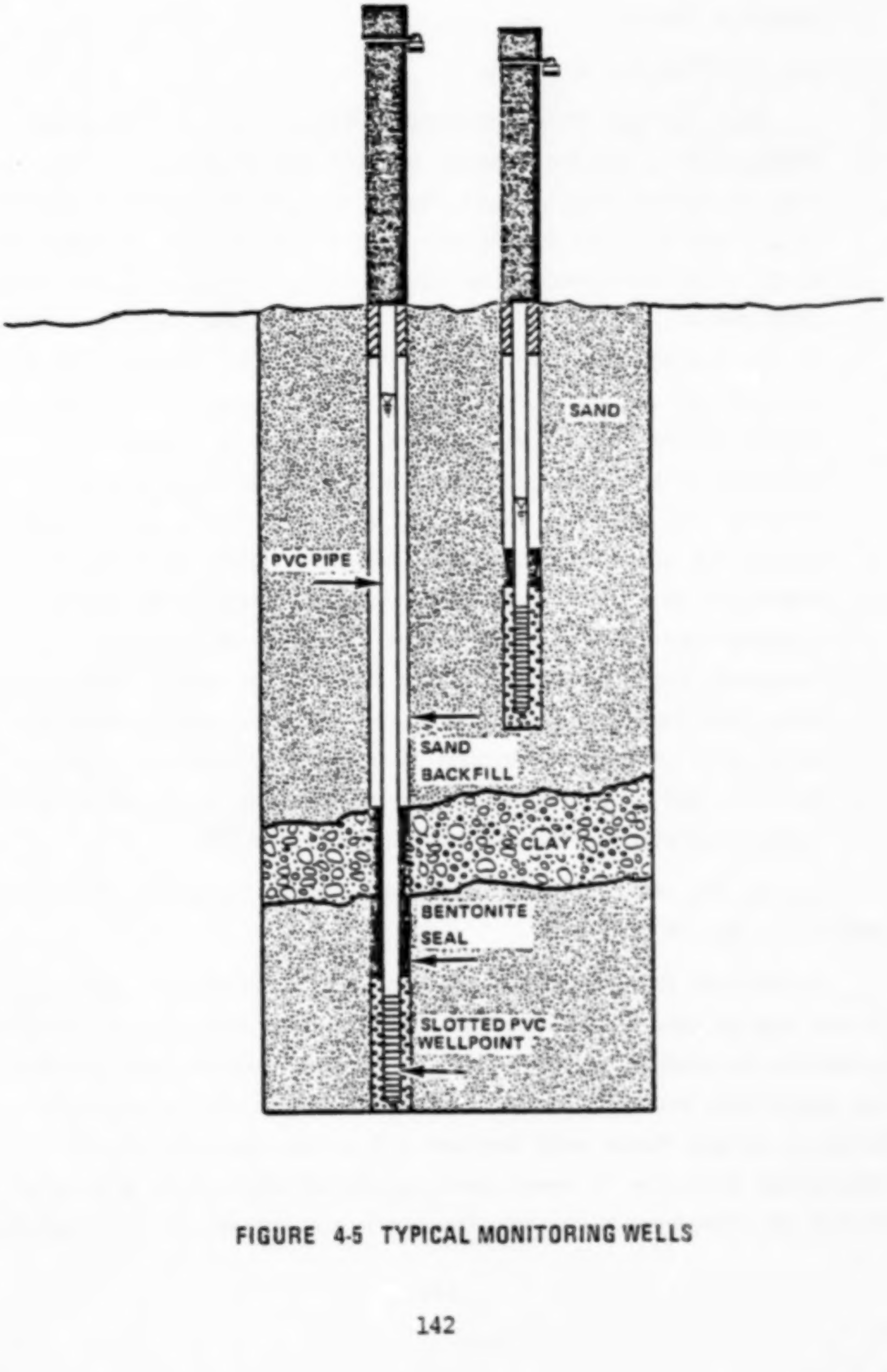
Wells located in waste should not be used for determinations. Upgradient and downgradient wells should be screened so that samples are obtained from the same water-bearing strata. When wells are being evaluated, local variations in the hydraulic gradient (such as may be caused by a nearby pumping well or a ground-water mound beneath the facility) should be considered, as well as any vertical gradients. In certain instances, springs or other discharge points of ground water may be adequate as sampling points.

(b) Construction of wells.

Well casings should preferably be at least 3 to 4 inches in diameter to allow for ease of pumping and sampling. A bentonite clay or cement seal or plug should be in place around the portion of the casing above the screen, and at the surface a cement or earth mound surrounding the casing should be built sloped away from the well to prevent surface water drainage down the outside of the casing. The top of the well should be covered with a locking cap and protected against vandalism and destruction by mobile equipment. An example well is shown in Figure 4-5. Labeling on the casing or wellhead should indicate the well location and number. Casing and well screens should be plastic, unless the waste type involved contains organic pollutants or is corrosive to plastic. If metal well parts are used, false readings may be obtained for some of the metal analyses. Determine from the driller's log if drilling mud or additives were used during well construction. If they were, ensure the wells were properly developed (flushed) and that all traces of drilling mud were removed as any mud present in the samples may affect analytical results, particularly for TDS.

If, in the estimation of the investigator, the existing system is adequate, proceed to 3.3.3.

In certain instances, existing monitoring wells not located close to the appropriate solid waste or alternate boundary may be used for Inventory determinations. If well(s) is(are) located downgradient to the applicable boundary and contamination due to the facility is detected in accordance with Section 3.3.4, the facility may be determined to be *not in compliance*, provided there is no potential source of interference between the waste and the well(s). Compliance



SAND
PVC PIPE
SAND
BACKFILL
CLAY
BENTONITE
SEAL
SLOTTED PVC
WELLPOINT

FIGURE 4-5 TYPICAL MONITORING WELLS

should not be assumed from a well(s) some distance downgradient of the boundary, because of the possibility of contamination existing at the boundary but not being detected at the downgradient well(s) due to attenuation or insufficient time for the contaminants to have reached the well(s).

If a facility has existing downgradient well(s) inside or upgradient to the appropriate boundary, and no contamination is detected, the facility may be assumed not to need further evaluation. Results indicating an exceeding of the MCLs at this interior location(s) may not be used for a non-compliance determination because of the possibility of attenuation of any contamination between this location and the appropriate boundary.

3.3.2 New Monitoring Systems

If a new monitoring well or additions to an existing system must be installed at the site, the system must be designed and installed with these additional considerations:

(a) Test borings or geophysical studies may have to be made to determine the water table gradient and location. Well locations can then be based on this information.

(b) Wells should be drilled or augered without the use of drilling mud, if possible. If mud is used, the well must be flushed properly.

(c) A well screen of sufficient length and correct slot size must be installed. Plastic screens are recommended for most installations less than 100 feet in depth, except when plastic is not compatible with the waste type. Plastic casing with thicker walls should be used with increasing depth. At depths greater than 100 feet, steel casings and stronger screens should be used to prevent compression and closing of the casing and screen. A properly sized sand or gravel pack or filter fabric wrap should be installed around the screen to prevent soil from entering the well.

(d) The downgradient wells should be placed as close as possible to the appropriate boundary at the depth where contamination is most likely. This depends to a large extent on the site hydrogeology and facility type and construction. Screen depth and length should be based on the anticipated plume location considering gradient direction, soil or rock type, and the distance from the waste deposit to the well. Examples are included in EPA-530/SW-611. Upgradient wells should then be set to sample from the same water-bearing strata.

(e) If monitoring will be conducted at an alternate boundary and this boundary is some distance from the facility, monitoring wells should be installed at several points between the alternate boundary and the facility. This will assist the investigator in determining whether any contamination observed at the alternate boundary is originating at the facility.

(f) Wells should not be installed in areas where waste has been deposited, or where it will be deposited before the end of the evaluation period.

(g) Resistivity or similar methods can be useful in identifying locations for monitoring wells or in supplementing the data from a limited number of wells.[6,7]

3.3.2.1 Special case - No Upgradient Sampling Possible

There may be facilities at which direct sampling of upgradient ground water is not possible. Such cases include:

- facilities located on hilltops
- facilities at which permission by an abutting landowner to collect samples or install wells is not granted [this assumes that ground water is mounded up to the facility's property line, as explained in 3.3.1(a)].

Other, unusual circumstances may also occur. However, the absence of readily available sampling opportunities should not cause the facility to be eliminated from evaluation.

Several methods are available in treating these cases. The goal should be to determine whether the ground-water quality which would exist if the facility were not present would be likely to exceed any of the Maximum Contaminant Levels contained in Appendix I. The influences on this water quality are the natural character of the geologic setting and human activities.

It should be possible to collect information on natural ground-water quality for the typical geologic setting in which the facility is located. Sources of this information may be those listed on page 4-3 and actual sampling from wells located in nearby, similar geologic settings (e.g., the nearest, similarly till-covered hilltop).

Certain MCLs may be exceeded naturally; as an example, where soluble or slightly soluble deposits of minerals containing one or more of the contaminants occur in the geologic setting (such as arsenopyrite—FeAsS). Past land use practices, such as fertilizer applications (high nitrate) or pesticide applications, may have influenced the ground-water quality at either the site of the facility prior to is operation, or at the nearby parallel site. Historical knowledge and an understanding of local ground-water flow are important elements of such an analysis.

It is more likely that presently operating (or recently closed) artificial sources of contamination located hydraulically upgradient from the facility, rather than the character of the geologic setting or the past land uses, will influence the MCLs in ground water.

If there is no evidence that natural (or pre-facility) ground-water quality exceeds any of the contaminant levels, any downgradient exceedence of the given MCL should be ascribed to the effects of the facility.

3.3.3 Monitoring Parameters

Determinations of non-compliance for the Inventory can only be made on the basis of the contaminants contained in Appendix I of the

Criterion. The contaminants listed in the Proposed Amendment to 40 CFR 257, Appendix A (chloride, color, etc.) may be used in the monitoring program as indicators, but non-compliance decisions are only to be based on the contaminant levels of Appendix I, Sections 1-4.

For all those facilities assigned a top (sole source aquifer) or high monitoring priority, monitoring should focus on the specific contaminants listed in Appendix I of the Criterion. At State discretion, facilities that received medium or low priority rankings may be monitored for indicator parameters only (except certain industrial waste facilities). While non-compliance decisions cannot be made based on some of these indicator parameters (TDS, Cl, COD, etc.), their initial use might be helpful in both reducing analytical expenses and reassigning priorities. However, where possible, all facilities are to be monitored for the contaminants listed in Appendix I, Sections 1-4 of the Criterion.

Additional or other parameters may be used at State discretion if experience indicates them to be useful in contamination evaluations where only a limited number of contaminants are being checked, such as suggested for single-source industrial waste facilities. An additional parameter might be selected because the concentration in the natural ground water is already at or above the level specified in the Criterion. The number of contaminants being analyzed for might be reduced after the first four samples to only those indicating changes.

(a) Landfills

- Top/high priority facilities - Total dissolved solids (TDS)* plus all of the Criterion inorganic contaminants.

---

* NOTE: TDS is only suggested as a parameter because of its general usefulness in ground-water quality studies. Non-compliance decisions cannot be made based on TDS as it is not one of the Criterion Appendix I contaminants.

Specific organic chemicals as indicated by presence of industrial waste sources. Coliform bacteria where the wells are located relatively close to the waste deposit or are located in fractured or solutioned rock.

- Top/high priority facilities handling single-source industrial wastes - Total dissolved solids plus at least three of the Criterion inorganic contaminants intrinsic to the waste source. Refer to Table 4-5. Organic chemicals or coliform where intrinsic to waste source.
- Medium/low priority facilities - At least four indicator parameters such as total dissolved solids, chloride, iron, manganese, TOC, COD, hardness, alkalinity, or other indicator parameters intrinsic to the waste source.

(b) Surface Impoundments

- Top/high priority facilities - Total dissolved solids plus at least three of the Criterion inorganic chemicals intrinsic to the waste source. Organic chemicals or coliform where intrinsic to waste source. Refer to Table 4-5.
- Medium/low priority facilities - Total dissolved solids, plus three other indicator parameters intrinsic to the waste source.

(c) Landspreading Facilities

- Sewage sludge - All priorities - Total dissolved solids, nitrate, total nitrogen, plus at least two (2) of the Criterion inorganic chemicals intrinsic to local industry wastewater. Refer to Table 4-5. Coliform where ground water is relatively shallow.
- Other wastes - All priorities - Total dissolved solids plus at least three of the Criterion inorganic chemicals intrinsic to the waste source. Coliform or organic chemicals where intrinsic to waste source.

TABLE 4-5

CONSTITUENTS IN INDUSTRIAL AND MUNICIPAL WASTEWATER HAVING SIGNIFICANT POTENTIAL FOR GROUND-WATER CONTAMINATION[8]

MINING (SIC 10, 11, and 12)

Metal and Coal Mining Industry (SIC 10, 11, and 12)

- pH
- Sulfate
- Nitrate
- Chloride
- Total dissolved solids
- Phosphate
- Copper
- Nickel
- Lead
- Zinc
- Tin
- Vanadium
- Radium
- Phenol
- Selenium
- Iron
- Chromium
- Cadmium
- Uranium
- Magnesium
- Silver
- Manganese
- Calcium
- Potassium
- Sodium
- Aluminum
- Gold
- Fluoride
- Cyanide

PAPER AND ALLIED PRODUCTS (SIC 26)

Pulp and Paper Industry (SIC 261 and 262)

- COD/BOD
- TOC
- pH
- Ammonia
- Phenols
- Sulfate
- Color
- Heavy metals
- Nitrogen
- Phosphorus
- Total dissolved solids
- Biocides

CHEMICALS AND ALLIED PRODUCTS (SIC 28)

Organic Chemicals Industry (SIC 286)

- COD/BOD
- pH
- Total dissolved solids
- Alkalinity
- TOC
- Total phosphorus
- Heavy metals
- Phenols
- Cyanide
- Total nitrogen
- Pesticides

(continued)

TABLE 4-5

(continued)

CHEMICALS AND ALLIED PRODUCTS (SIC 28) - (continued)

Inorganic Chemicals, Alkalies, and Chlorine Industry (SIC 281)

- Acidity/alkalinity
- Total dissolved solids
- Chloride
- Sulfate
- COD/BOD
- TOC
- Chlorinated benzenoids and polynuclear aromatics
- Phenols
- Fluoride
- Total phosphorus
- Cyanide
- Mercury
- Chromium
- Lead
- Titanium
- Iron
- Aluminum
- Boron
- Arsenic

Plastic Materials and Synthetics Industry (SIC 282)

- COD/BOD
- pH
- Phenols
- Total dissolved solids
- Sulfate
- Phosphorus
- Nitrate
- Organic nitrogen
- Chlorinated benzenoids and polynuclear aromatics
- Ammonia
- Cyanide
- Zinc
- Mercaptans

Nitrogen Fertilizer Industry (SIC 2873)

- Ammonium
- Chloride
- Chromium
- Total dissolved solids
- Nitrate
- Sulfate
- Organic nitrogen compounds
- Zinc
- Calcium
- COD
- Iron, total
- pH
- Phosphate
- Sodium

Phosphate Fertilizer Industry (SIC 2874)

- Calcium
- Dissolved solids
- Fluoride
- pH
- Phosphorus
- Acidity
- Aluminum
- Arsenic
- Iron
- Cadmium
- Mercury
- Nitrogen
- Sulfate
- Uranium
- Vanadium
- Radium

(continued)

TABLE 4-5

(continued)

PETROLEUM AND COAL PRODUCTS (SIC 29)

Petroleum Refining Industry (SIC 291)

Ammonia
Chromium
COD/BOD
pH
Phenols
Sulfide
Total dissolved solids
Chloride
Color
Copper
Cyanide
Iron
Lead
Mercaptans
Nitrogen
Odor
Total phosphorus
Sulfate
TOC
Turbidity

PRIMARY METALS (SIC 33)

Steel Industry (SIC 331)

pH
Chloride
Sulfate
Ammonia
Cyanide
Phenols
Iron
Nickel
Tin
Chromium
Zinc

ELECTRIC, GAS, AND SANITARY SERVICES (SIC 49)

Power Generation Industry (SIC 491)

COD/BOD
pH
Polychlorinated biphenyls
Total dissolved solids
Oil and grease
Copper
Iron
Zinc
Chromium
Other corrosion inhibitors
Phosphorus
Free chlorine
Organic biocides
Sulfur compounds
Heat
Vanadium

Municipal Sewage Treatment (SIC 495)

pH
COD/BOD
TOC
Alkalinity
Detergents
Total dissolved solids
TKN
Nitrate
Ammonium
Phosphate
Chloride
Sodium
Potassium
Sulfate
Copper
Lead
Tin
Zinc
Various Organics

3.3.4 Sampling

Sampling technique in ground-water monitoring is very important, and standard methods such as those outlined in Procedures Manual for Ground-Water Monitoring at Solid Waste Disposal Facilities[3] should be used. A brief set of guidelines follows:

(a) Check equipment and make arrangements with the laboratory for sample transportation.

(b) Measure the static water level in the well.

(c) Flush the well to remove standing water. An amount equal to five times the volume of the saturated casing should be removed in high-yield formations (in low permeability strata, one volume will suffice).

(d) Allow the well to recharge to the static water level (may require more than one day in low permeability strata).

(e) Clean and/or flush sampling equipment with distilled water between samples.

(f) Maintain non-aerated conditions during collection. Do not allow the water to bubble or splash into the sample container. Recent experience with several types of pumps is described in Reference No. 9. Samples should not be filtered.

(g) Follow specified preservation methods for each parameter before shipment.

(h) Clean equipment. Make sure well is securely capped.

(i) Analysis should be conducted per EPA-600/4-79-020.[10] Metals should be analyzed for total recoverable metals.

3.3.5 Data Interpretation

For a non-compliance determination to be made, there must be clear evidence that contaminant concentrations in the ground-water downgradient of the facility exceeds one of the two cases below:

(1) greater than the maximum contaminant levels (MCLs) designated in Appendix I of the Criterion and

(2) the contaminant concentrations upgradient of the facility if the upgradient concentrations exceed the MCL either naturally or from other sources of contamination.

To avoid potential decision errors, a sequential sampling and data interpretation scheme is suggested. This is due to variations in monitoring data levels because of natural fluctuations in ground-water quality and laboratory measurement errors. Non-compliance assessments can be complex; casual interpretation of the data is normally insufficient to make determinations with confidence.

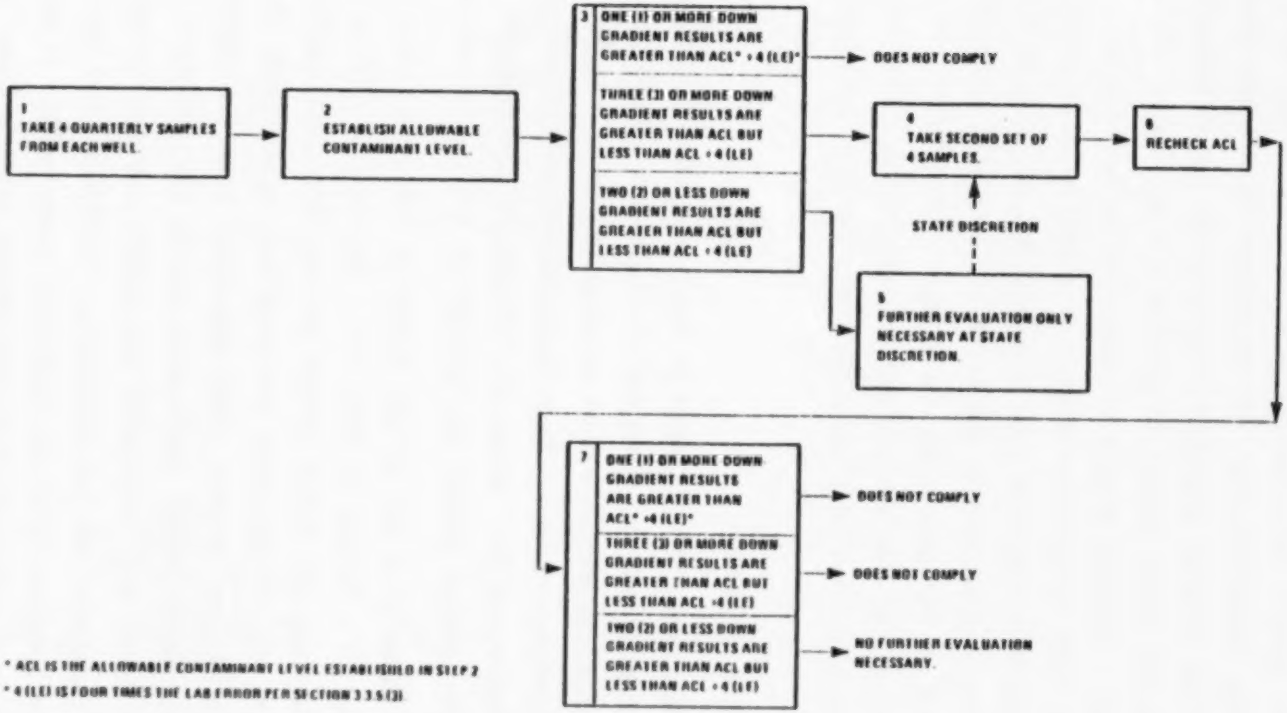
Data Interpretation Scheme for High Priority Facilities

As guidance, one possible data interpretation scheme is presented in Figure 4-6 which is a ground-water impact decision flow chart. This method accounts for data fluctuations and normal laboratory measurement errors. It enables the evaluator to identify those facilities where non-compliance is evident, as well as those facilities for which the analytical results do not clearly indicate non-compliance. The decision process for this latter, more difficult case is based on probability theory, resulting in a high level of confidence in the non-compliance decision. The theoretical background is presented in the Appendix to this Chapter.

The decision flow process outlined in Figure 4-6 is described below:

(1) Take four quarterly samples.

The initial step when monitoring for the Criterion contaminants is to take four quarterly samples over a 12-month period from each upgradient and downgradient well. The quarterly timing should be based on seasonal considerations and facility operating patterns.


1
TAKE 4 QUARTERLY SAMPLES FROM EACH WELL.
2
ESTABLISH ALLOWABLE CONTAMINANT LEVEL.
3
ONE (1) OR MORE DOWN GRADIENT RESULTS ARE GREATER THAN ACL* + 4 (LE)*
THREE (3) OR MORE DOWN GRADIENT RESULTS ARE GREATER THAN ACL BUT LESS THAN ACL + 4 (LE)
TWO (2) OR LESS DOWN GRADIENT RESULTS ARE GREATER THAN ACL BUT LESS THAN ACL + 4 (LE)
DOES NOT COMPLY
4
TAKE SECOND SET OF 4 SAMPLES.
STATE DISCRETION
5
FURTHER EVALUATION ONLY NECESSARY AT STATE DISCRETION.
6
RECHECK ACL
7
ONE (1) OR MORE DOWN GRADIENT RESULTS ARE GREATER THAN ACL* +4 (LE)*
THREE (3) OR MORE DOWN GRADIENT RESULTS ARE GREATER THAN ACL BUT LESS THAN ACL +4 (LE)
TWO (2) OR LESS DOWN GRADIENT RESULTS ARE GREATER THAN ACL BUT LESS THAN ACL + 4 (LE)
DOES NOT COMPLY
DOES NOT COMPLY
NO FURTHER EVALUATION NECESSARY.

* ACL IS THE ALLOWABLE CONTAMINANT LEVEL ESTABLISHED IN STEP 2

* 4 (LE) IS FOUR TIMES THE LAB ERROR PER SECTION 3.3.5 (3).

1/81

FIGURE 4.6 FLOW CHART - GROUND WATER IMPACT DECISION

(2) Establish allowable contaminant levels.

The allowable contaminant level (ACL) for each parameter should be chosen after the initial set of four samples. If none of the upgradient values recorded are greater than the maximum contaminant levels (MCL) specified by the Criterion, then the ACL level is the Criterion MCL. If upgradient values are above the MCL, then the highest upgradient contaminant level detected in the upgradient wells should be used as the allowable contaminant level (ACL). Caution should be exercised in setting an abnormally high upgradient level that appears in only one sample, as it might have resulted from a localized influence and might not be truly indicative of the normal or seasonal peak level of the natural or background ground water. Where there are multiple upgradient wells, use the highest values from all the wells or the values from that well which is most clearly upgradient of the facility.

(3) Decision guidance.

The data are best arranged in tabular form for evaluation. One possible format is presented in Table 4-6. Also presented are hypothetical sample values as examples to illustrate the decision-making process. Each downgradient well should be treated individually. Means or averages of downgradient analytical results should not be used in making determinations.

The column (4 x LE) is the universal lab error from Table 4-7 multiplied by a factor of four (4). This multiplier is used to assure that the lab error ranges for any given downgradient results do not overlap with the potential measurement error range of the upgradient values. When the error from the reporting lab is clearly established, that value may be used in place of the value in Table 4-7. Universal lab errors for the Criterion organic chemicals are not available; therefore, the lab error should be obtained from the reporting laboratory. It should be stressed that only qualified labs should perform these analyses,

TABLE 4-6

EXAMPLE FORMAT
GROUND-WATER MONITORING DATA EVALUATION
HYPOTHETICAL VALUES

Contaminant	MCL	Upgradient Well #A Quarterly Results 1	2	3	4	ACL	4 x LE	Downgradient Well #B Quarterly Results 1	2	3	4	Number of Times Exceeds ACL + (4 x LE)	Number of Times Exceeds MCL<ACL + (4 x LE)
Arsenic	0.05	0.01	0	0	0	0.05	0.0132	0	0.01	0	0.01	0	0**
Barium	1.0	0.70	0.45	0.83	0.25	1.0	0.0264	0.50	0.35	0.90	1.0	0	0**
Cadmium	0.01	0.008	0.01	0.005	0.003	0.01	0.0040	0.013	0.012	0.013	0.009	0	3***
Chromium	0.05	0	0	0	0	0.05	0.0024	0.051	0.048	0.051	0.051	0	3***
Lead	0.05	0.060	0.035	0.065	0.080	0.08*	0.0192	0.068	0.050	0.075	0.090	0	1**
Mercury	0.002	0.001	0.001	0	0.002	0.002	0.0008	0.001	0.002	0.001	0.001	0	0**
Nitrate (as N)	10.0	14.0	11.5	7.8	6.5	14.0*	0.704	14.2	12.6	10.9	10.5	0	1**
Selenium	0.01	0.005	0	0	0.002	0.01	0.0048	0.005	0.001	0.001	0.007	0	0**
Silver	0.05	0.010	0.025	0	0.005	0.05	0.0084	0.014	0.057	0.009	0.020	0	1**
Fluoride	1.4-2.4 ****												

* The ACL for these parameters is greater than the MCL because upgradient values greater than MCL were recorded.

** Analysis for these contaminants may be discontinued in the second series at State discretion.

*** A second set of samples should be taken because three or more of the downgradient results for this well were greater than the ACL but less than the ACL + (4 x LE).

**** Contaminant level varies as a function of temperature.

TABLE 4-7

LABORATORY ERROR FOR CRITERIA CONTAMINANTS*

Parameter	Analytical Method	Potential Analytical Error at the MCL
Arsenic	AA furnace (206.2)	±0.0033 mg/l**
Barium	AA furnace (208.2)	±0.0066 mg/l**
Cadmium	AA furnace (213.2)	±0.00099 mg/l**
Chromium	AA furnace (218.2)	±0.0006 mg/l**
Lead	AA furnace (239.2)	±0.0048 mg/l**
Mercury	Automatic cold vapor (245.2)	±0.00021 mg/l**
Selenium	AA furnace (270.2)	±0.0012 mg/l**
Silver	AA furnace (272.2)	±0.0021 mg/l**
Nitrate as nitrogen	Colorimetric (353.2) Cadmium red	±0.176 mg/l***
Fluoride	Potentiometric (340.2)	~±0.03 mg/l***

* From Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, March 1979, EMSL-Cincinnati, Ohio, U.S. Environmental Protection Agency.

** Calculated for a universal laboratory error as three times the established single lab error.

***Determined as the universal laboratory error.

because poor quality control can result in errors much larger than those listed in Table 4-7.

The downgradient data should be compared to the ACL for each contaminant to determine the number of times the results for that well exceed the value ACL + (4 x LE) for the contaminant. If, for any contaminant, there are one or more exceedences in any downgradient well of the value ACL + (4 x LE), it may be determined that *the facility does not comply with the Criterion*.

If, for any contaminant, there are three or more exceedences of the ACL by less than four times the laboratory error, a second set of four samples should be taken. This set may consist of four samples at one month intervals during the seasonal period when the exceedences were recorded, or another set of quarterly samples. This sampling interval should be selected based on seasonal factors, such as leachate production, rate of ground-water movement, and facility operational procedures.

After the second set of samples is completed, the upgradient values should be checked to determine if there are any changes necessary in the ACL. The second data set should be tabulated and the downgradient values compared to the values of the ACL and 4 x LE as follows:

(a) If, for any contaminant, there were one or more exceedences of the ACL in any downgradient well by a margin of more than four times the LE, *the facility does not comply with the Criterion*.

(b) If, for any contaminant, there were three or more exceedences of the ACL during the second sampling set, *the facility does not comply with the Criterion*.

(c) If, for each contaminant, there were no more than two exceedences of the ACL by a margin of less than four times the LE, no further evaluation is necessary for the Inventory unless the State wishes to continue sampling for potential future ground-water quality changes.

Data Interpretation for Medium and Low Priority Facilities

For those medium and low priority facilities for which only indicator parameters were examined, it is likely that the first four quarterly samplings will demonstrate that one or more of the downgradient indicator parameter values exceeded the highest upgradient value. In such cases, sampling should continue, analyzing for the applicable contaminants identified in Appendix I of the Criterion.

Additional Guidances

1. Data collected from previous sampling of adequate monitoring systems may be used to guide Inventory sampling and analytical programs, particularly for facilities assigned medium and low priorities.

2. When the evaluations are being made, caution should be exercised in evaluating the initial analyses of iron and manganese or other contaminants which might result from a well casing or disturbance of the soil.

3. In areas where there are other potential sources of contamination such as industrial activity, sewers, septic systems, and other disposal facilities, contamination may originate from another upgradient source. Careful checking of the paired results over the period of time is necessary to determine that the facility in question is actually the source of contamination.

4.0 References

1. Safe Drinking Water Act. PL-93-523, Section 1424(e). 42 U.S.C. 300 f, 300 h-3(e); 88 Stat. 1660 et seq.

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7. Texas Department of Health, Division of Solid Waste Management. "Use of Earth Resistivity in Solid Waste Management." Technical Guide #1, March, 1980.

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10. "Methods for Chemical Analysis of Water and Wastes." EPA 600/4-79-020, EMSL, ORD, U.S. Environmental Protection Agency, Cincinnati, Ohio, March, 1979.

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APPENDIX

THEORETICAL BACKGROUND

Consider a single contaminant with a pre-determined critical value and let P_0 denote the probability an observation is below this critical value. If four independent observations are made, then

Probability of 0 exceedence $= P_0^4$,
Probability of 1 exceedence $= 4P_0^3(1-P_0)$,
Probability of 2 exceedences $= 6P_0^2(1-P_0)^2$.

Hence, the probability of the site passing is:

$$P_1 = P_0^4 + 4P_0^3(1-P_0) + 6P_0^2(1-P_0)^2.$$

Now the probability the site first fails and then passes on the second sampling is $(1-P_1)P_1$, and so the overall probability the site passes after either the first or second sampling is:

$$P_2 = P_1 + (1-P_1)P_1.$$

If there are three downgradient wells, the probability that the site passes is P_2^3. If there are ten contaminants and also three downgradient wells, the probability that the site passes for all contaminants is given by:

$$P_3 = P_2^{30}.$$

The assumptions made in this analysis are that the observations for the downgradient wells are independent of each other, and that the contaminants act independently of each other and also of the wells. Another assumption is that P_0 is the same for all contaminants in the derivation of P_3. Small differences in P_0 between contaminants should cause only small changes in P_3.

As an example, suppose, for a certain contaminant, that the concentration median is such that five-eighths of all observations exceed the critical value and three-eighths of all observations are less than the critical value. Therefore, if we take only one observation, the chance that it is less than the critical value is three-eighths: i.e., $P_0 = 3/8$. Consider the initial sample of four observations:

Probability of 0 exceedence = $(3/8)^4$ = 0.01978
Probability of 1 exceedence = $4(3/8)^3(5/8)$ = 0.13184
Probability of 2 exceedences = $6(3/8)^2(5/8)^2$ = 0.32958

The probability of the well passing on the basis of the first sample alone is the sum of these probabilities, 0.48120, and is denoted by P_1. If a second series is called for, the probability of a site passing with two or less exceedences in the second series is now 0.51880 x 0.48120 = 0.24965, and consequently, the overall probability of a site passing after either the first or second series is:

$$0.48120 + 0.24965 = 0.73075 \ (=P_2).$$

When there are three individual wells, the probability of the site passing is then $(0.73085)^3 = 0.39037$.

If the problem is extended from one contaminant to ten contaminants, the probability the site is passed as being in compliance is then:

$$(0.39037)^{10} = 0.00008 \ (=P_3).$$

This assumes all the contaminants have the same characteristics as the single contaminant discussed previously. The small value of 0.00008 implies it is exceptionally unlikely a site with high contamination levels will be passed as being in compliance.

Table I shows the relationship between the final decision made on a site and the initial probability of a contaminant exceeding the critical value.

TABLE I

Probability a single observation is below the critical value (P_0)	Probability of the well being accepted on the initial sample (P_1)	Probability of the well being accepted after either first or second samples (P_2)	Probability a site with three wells and ten contaminants is accepted (P_3)
7/8	0.9929	0.9999	0.9970
3/4	0.9492	0.9974	0.9249
5/8	0.8484	0.9770	0.4978
1/2	0.6875	0.9023	0.0458
3/8	0.4812	0.7309	0.0001
1/4	0.2617	0.4549	0.0000
1/8	0.0789	0.1515	0.0000

CHAPTER 4

GROUND WATER

Criterion Compliance Decision

☐ *Does Not Require Further Evaluation*

☐ *Does Not Comply*

1. Does ground water naturally contain more than 10,000 mg/l TDS, and is it not being used as a human drinking water source?

☐ YES (*DOES NOT REQUIRE FURTHER EVALUATION*)

- ☐ Ground water has naturally more than 10,000 mg/l TDS, TDS = ____________________ and is not used as a human drinking water source
- ☐ Ground water is not present in usable quantities beneath the site

☐ NO (continue to 2)

- ☐ Ground water has less than 10,000 mg/l TDS
- ☐ Ground water is being used as a drinking water source

2. Rank facility according to its contamination potential.

Landfills

- ☐ Facility overlies a Sole Source Aquifer (high priority)
- ☐ Ranking from Table 4-2
  Saturated zone permeability __________ cm/sec
  Unsaturated zone thickness __________ m
  Unsaturated zone permeability __________ cm/sec
- ☐ Ranking is modified by climatic or site-specific characteristics from Table 4-2

☐ High priority

☐ Medium priority

☐ Low priority

Surface Impoundments

- ☐ Facility overlies a Sole Source Aquifer (high priority)
- ☐ Ranking from Table 4-3
  Saturated zone rating __________
  Unsaturated zone rating __________
- ☐ Ranking from Table 4-3 is modified by climatic, site-specific, or waste-specific characteristics

- ☐ High priority
- ☐ Medium priority
- ☐ Low priority

Landspreading Facilities

- ☐ Sludge nitrogen is being applied in excess of crop or vegetative demand (high priority)
- ☐ Ranking from Table 4-2 for waste facilities handling other than sewage sludge

- ☐ High priority
- ☐ Medium priority
- ☐ Low priority

3. Has an underground drinking water source been contaminated by the facility beyond the solid waste (or alternate boundary)?

☐ YES (*DOES NOT COMPLY*)

- ☐ Monitoring shows contamination of a drinking water source. Contaminating substances and concentrations: ____________
____
____

☐ NO (*DOES NOT REQUIRE FURTHER EVALUATION*)

- ☐ Monitoring shows no contamination beyond the solid waste (or alternate boundary)

CHAPTER 5

ENDANGERED AND THREATENED SPECIES

1.0 Criterion and Definitions

> **§ 257.3-2 Endangered species.**
>
> (a) Facilities or practices shall not cause or contribute to the taking of any endangered or threatened species of plants, fish, or wildlife.
>
> (b) The facility or practice shall not result in the destruction or adverse modification of the critical habitat of endangered or threatened species as identified in 50 CFR Part 17.
>
> (c) As used in this section:
>
> (1) "Endangered or threatened species" means any species listed as such pursuant to Section 4 of the Endangered Species Act.
>
> (2) "Destruction or adverse modification" means a direct or indirect alteration of critical habitat which appreciably diminishes the likelihood of the survival and recovery of threatened or endangered species using that habitat.
>
> (3) "Taking" means harassing, harming, pursuing, hunting, wounding, killing, trapping, capturing, or collecting or attempting to engage in such conduct.

2.0 Inventory Procedure

The approach to the endangered species criterion for the purpose of the inventory is as follows:

(a) Determine if there are any endangered or threatened species likely to be affected by the facility.

(b) Determine if the facility results in the destruction or adverse modification of the critical habitat of an endangered or threatened species as identified by 50 CFR Part 17, pursuant to Section 4 of the Endangered Species Act.

(c) Determine if the facility causes or contributes to the taking of an endangered or threatened species as identified by 50 CFR Part 17.

Figure 5-1 presents the decision flow chart.

2.1 Additional Definitions

As used in this chapter:

(a) "Range" means the geographic area in which a species normally lives, including those areas used for movement, feeding, nesting, breeding or harborage. The ranges for endangered or threatened species are designated by the Office of Endangered Species of the U.S. Fish and Wildlife Service and are listed with the species in Appendix 5-A.

(b) "Critical habitat" means a specific area on which are found those physical or biological features essential to the conservation of a species and which require special management considerations or protection. Critical habitats are designated by the Office of Endangered Species of the U.S. Fish and Wildlife Service and are listed in Appendix 5-B.

3.0 Resolution of Decision Flow Chart Questions

3.1 Are any endangered or threatened species as listed pursuant to the Endangered Species Act of 1973 (16 U.S.C. 1530 et. seq. as amended) in 50 CFR Part 17 likely to be affected by the facility?

For the purposes of the Inventory, it can be assumed that endangered or threatened species may only be affected by facilities occurring within the range of the species. Thus, the first step is to identify the endangered or threatened species whose ranges encompass the facility. This is determined by referring to the synopsis of the 50 CFR Part 17 listings of endangered or threatened species (Appendix 5-A), promulgated by the Office of Endangered Species (OES) of the Fish and Wildlife Service, U.S. Department of the Interior. The listings describe the geographic range within which the species are endangered or threatened. OES assistance may be necessary to clarify

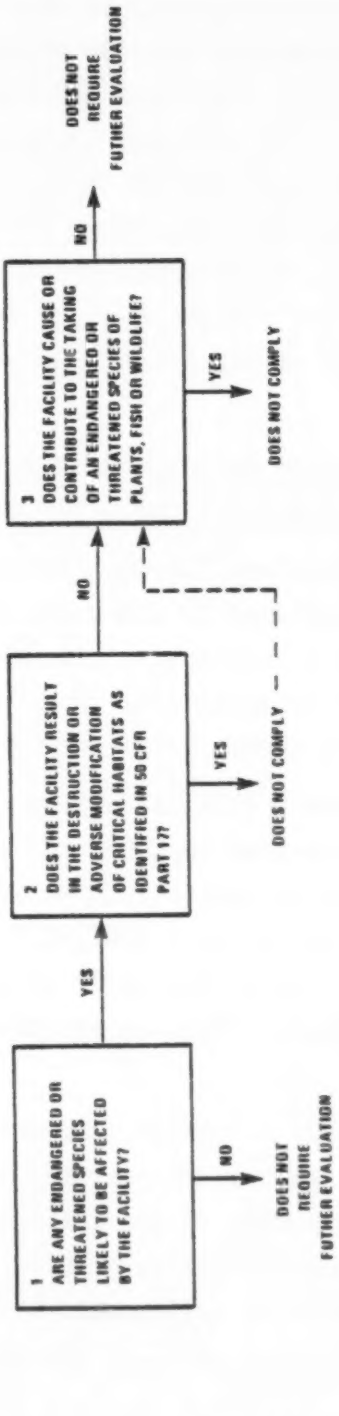
1
ARE ANY ENDANGERED OR THREATENED SPECIES LIKELY TO BE AFFECTED BY THE FACILITY?
NO
DOES NOT REQUIRE FUTHER EVALUATION
YES
2
DOES THE FACILITY RESULT IN THE DESTRUCTION OR ADVERSE MODIFICATION OF CRITICAL HABITATS AS IDENTIFIED IN 50 CFR PART 17?
YES
DOES NOT COMPLY
NO
3
DOES THE FACILITY CAUSE OR CONTRIBUTE TO THE TAKING OF AN ENDANGERED OR THREATENED SPECIES OF PLANTS, FISH OR WILDLIFE?
YES
DOES NOT COMPLY
NO
DOES NOT REQUIRE FUTHER EVALUATION

FIGURE 5-1 FLOW CHART – ENDANGERED SPECIES

1/81

those instances where the listed range is not State specific and to ensure that the listing of species is current. As the ranges listed for each species sometimes include a larger geographic area than the species currently inhabits, discussions should be held with the State agency or agencies involved in endangered species management, and/or the OES where necessary to determine where each species is actually known to occur within the State. The next step is to compile the information from the State agencies or the OES on maps, delineating known areas inhabited by each species. These maps can then be compared against the location of a facility to determine which species the facility needs to be evaluated for. If the facility is not located within the range of an endangered or threatened species, *then it does not require further evaluation*.

3.2 Does the facility result in the destruction or adverse modification of the critical habitat as identified in 50 CFR Part 17?

The first step is to determine whether the facility is in the critical habitat. This is accomplished by comparing the facility location with the critical habitat boundaries. The location of the critical habitats is detailed in Appendix 5-B. This listing should be checked with the OES or the State agency to ensure that it is current.

If the facility is not within a critical habitat, then for the purpose of the Inventory, it is assumed that the facility does not result in the destruction or adverse modification of the critical habitat. Facilities which are not within a critical habitat must still be evaluated against the prohibition on taking of an endangered or threatened species, including species within a designated critical habitat (Section 3.3).

If the facility is in a critical habitat, the State must conduct its own assessment to determine whether the facility has resulted in the destruction or adverse modification of the critical habitat. Note that the mere location of a facility within a critical habitat does not necessarily mean that the facility will result in the destruction or adverse modification of the habitat (e.g., a facility located in a valley may be within the critical habitat of an endangered bat, but the bat may only exist in caves near the ridge tops, remaining unaffected by the facility below). The assessment should be carried out with consultation or assistance from the appropriate State agencies (endangered species or fish and wildlife offices), regional or local OES office, or private consultant. If a Federal agency is involved through lending aid, project permits, or other activities, check with that Federal agency to see if the OES determination has been or will be made.

There are several instances where previous evaluations may enable the determination that the facility neither results in the destruction or adverse modification of the critical habitat of endangered or threatened species nor causes or contributes to the taking of any endangered or threatened species of plants, fish, or wildlife.

(a) If the State has a cooperative agreement with the OES under Section 6(c) of the Endangered Species Act whereby the State endangered species agency maintains a program for the conservation of endangered or threatened species in accordance with the ESA, check with the State endangered species agency for a previous assessment of the facility. Such an assessment is usually made as part of the State's review, inspection, or permit procedures for various State programs or through the State comments on a Federal permit application by the facility (i.e., a Clean Water Act Section 404 permit).

Where the facility has passed the State endangered species agency's assessment of the facility's impact upon endangered or threatened species and critical habitats, *then the facility does not require further evaluation for this Criterion*. This question is resolved by checking past records of the facility.

(b) Where the facility is on Federal land or Federal money is involved in the construction or operation of the facility, an assessment of the facility's impact on endangered or threatened species might have been made by the Office of Endangered Species, a State having a cooperative agreement, or the involved Federal agency. If the facility passed this assessment, *then the facility does not require further evaluation for this Criterion.* Check the past records of the facility, the appropriate State agency, the Office of Endangered Species, or the involved Federal agency to determine this.

(c) Where the facility has an individual permit under Section 404 of the Clean Water Act, and the environmental assessment conducted prior to the issuance of the permit contained a determination that the facility was unlikely to adversely impact upon endangered and threatened species and critical habitats, *then the facility does not require further evaluation for this Criterion.* This can be checked by examining the records of the facility. If necessary, consult with the appropriate Army Corps of Engineers District or the State 404 permitting agency (where applicable).

(d) In addition, for the purpose of the Inventory, if an environmental assessment considering endangered or threatened species has been made nearby with no adverse impacts noted and consultation with the appropriate State agencies or OES indicate that the same situation exists at the facility under consideration, *then the facility does not require further evaluation for this Criterion.* The determination to use a nearby environmental assessment will have to be made using State discretion based on the circumstances. Normally, the appropriate State agency will have records or information about this assessment.

Lacking one of the above previous assessments, determinations will be facility specific and made on the best judgment of the evaluator(s). No standard or approved procedure(s) exist at this time for this evaluation, therefore guidance from the appropriate State agency or OES is recommended prior to and during the evaluation. The factors to be considered in making a determination are:

- type of critical habitat
- size of critical habitat and size of facility

- sensitivity of critical habitat to adverse impacts
- species characteristics for which the critical habitat has been designated (e.g., requirements for food, harborage, water, reproduction, etc.)
- facility design and operational characteristics

Where it is determined that a facility directly or indirectly results in the destruction or adverse modification of a critical habitat which appreciably diminishes the likelihood of the survival and recovery of the endangered and threatened species using that habitat, *then the facility does not comply with this portion of the Criterion.*

3.3 Does the facility cause or contribute to the taking of any endangered or threatened species of plants, fish, or wildlife?

If it has been determined that the facility results in the destruction or adverse modification of a critical habitat, then the facility results in the taking of the subject endangered species, and *the facility does not comply with this part of the Criterion.* The facility must still be evaluated for other species whose ranges include the area of the facility.

If the facility meets the following three requirements, then the facility can be assumed not to cause a taking and *does not require further evaluation for this Criterion.*

- The facility has no record of causing or contributing to the taking of an endangered or threatened species.
- The facility does not violate the Air, Surface Water, Floodplains, or Disease Criteria.
- The facility site and the immediate area are not inhabited by any endangered or threatened species.

The facility can be checked against the first requirement by reference to existing office records and consultation with the OES or the appropriate State agency. The second requirement can be checked by referring to the Inventory records for each facility. The last requirement should be checked through consultation with the OES, the appropriate State agency, or other consultant. Where the determination of habitation cannot be made in the office, a visit to the site will be necessary. The site visit should be made with consultation or assistance from the previously discussed sources. The decision as to what constitutes the immediate area around the facility should be made by the State with consideration for the species being evaluated and the habitat value of the surrounding area.

If the facility does not meet all of the three requirements, then the facility must be evaluated for the taking of endangered or threatened species. Those facilities which have no record of causing or contributing to the taking of an endangered or threatened species and have no endangered or threatened species inhabiting the immediate area, but do not comply with or have not been evaluated for the Air, Surface Water, Floodplains, or Disease Vectors criteria may be evaluated just with respect to those Criteria. For example, a facility which met all of the aforementioned requirements, but did not comply with or had not been evaluated against the Air Criterion, would need only to be evaluated for a potential taking of a species due to air impacts (e.g., open burning).

If the facility has a past record of causing or contributing to the taking of an endangered or threatened species, or there is an endangered or threatened species inhabiting the immediate area, the facility will need to be evaluated for causing or contributing to the taking of an endangered or threatened species. Assistance is recommended and should be obtained from the appropriate State agencies, the OES, or a private consultant.

The evaluation determining whether a disposal facility causes or contributes to the taking of an endangered or threatened species will be facility specific and made on the best judgment of the evaluator(s). Again, consultation with the appropriate State agency or OES is advised. Some of the factors to be considered in making a determination are:

- type of species and species habitat
- species characteristics (e.g., nesting and breeding behavior; range; food, water and harborage needs; growth cycles)

- sensitivity of species or habitat to adverse environmental impacts caused by the facility
- proximity of facility to species or species habitat
- facility size, design, and operational characteristics

Activities and impacts by which a facility may be causing or contributing to the "taking" of endangered or threatened species are:

- harassing, harming, pursuing, hunting, wounding, killing, trapping, capturing, or collecting of species (this always constitutes a "taking" and non-compliance with this Criterion)
- loss or adverse modification of habitat (including air and water pollution impacts)
- infringement on breeding, nesting, and feeding activities
- interference with species movement

The latter three factors may or may not constitute a "taking" and require careful consideration and expert consultation before making the determination.

Where it is determined that a facility is causing or contributing to the taking of an endangered or threatened species, *then the facility does not comply with this Criterion.*

APPENDIX 5-A

LIST OF ENDANGERED AND THREATENED SPECIES

DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

Republication of the Lists of Endangered and Threatened Species and Correction of Technical Errors in Final Rules

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Final rule: republication of the U.S. Lists of Endangered and Threatened Wildlife and Plants and correction of technical errors.

SUMMARY: The Service hereby issues a republication of the lists of Endangered and Threatened Wildlife and Plants, 50 CFR 17.11 and 17.12. The last republication was January 17, 1979 (44 FR 3636–3654). Technical errors are also corrected.

DATE: These lists include all species listed as of May 10, 1980, and are effective May 20, 1980, except the bonytail chub (final rule effective May 23, 1980) and the Goodenough gambusia (final rule effective May 30, 1980). The texts of 50 CFR 17.11 and 17.12 are also effective May 20, 1980 (*see* 45 FR 13010, February 27, 1980).

ADDRESSES: Comments concerning this republication should be sent to the Director (OES), U.S. Fish and Wildlife Service, U.S. Department of the Interior, Washington, D.C. 20240.

FOR FURTHER INFORMATION CONTACT: Mr. John L. Spinks, Jr., Chief, Office of Endangered Species, Washington, D.C. 20240, (703) 235–2771.

SUPPLEMENTARY INFORMATION: The lists incorporate species officially listed as Endangered or Threatened under the Endangered Species Act of 1973, as amended, and 50 CFR Part 424. The previous republication was January 17, 1979 (44 FR 3636–3654). The animal species added to § 17.11 since that publication are Caribbean monk seal, Ryukyu rabbit, Simien fox, Malabar large spotted civet, Iriomote cat, Fea's muntjac, Formosan sika, Ryukyu sika, North China sika, Shansi sika, South China sika, Corsican red deer, Barbary deer, Yarkand deer, Bactrian deer, western giant eland, Jentink's duiker, Tora hartebeest, Swayne's hartebeest, Zanzibar suni, sand gazelle, Saudi Arabian gazelle, Pelzeln's gazelle, Arabian gazelle, Arabian tahr, West African manatee, Grevy's zebra, Hartmann's zebra, Virginia big-eared bat, Ozark big-eared bat, red-necked parrot, saltwater crocodile, two unnamed boas from Mauritius, Virgin Islands tree boa, San Esteban Island chuckwalla, Fiji banded and Fiji crested iguanas, Bolson tortoise, Plymouth red-bellied turtle, totoaba, bonytail chub, Goodenough gambusia, and Kern primrose sphinx moth. Plant species added to §17.12 are bunched arrowhead, Tennessee purple coneflower, *Lipochaeta venosa*, Truckee barberry, Chapman rhododendron, green pitcher plant, Harper's beauty, purple-spined hedgehog cactus, Wright fishhook cactus, Uinta Basin hookless cactus, Lee pincushion cactus, Arizona hedgehog cactus, Brady pincushion cactus, Siler pincushion cactus, Raven's mazanita, MacFarlane's four-o'clock, Lloyd's hedgehog cactus, black lace cactus, Peebles Navajo cactus, Kuenzler hedgehog cactus, Nicoll's Turk's head cactus, Knowlton cactus, *Stenogyne angustifolia* var. *angustifolia*, *Haplostachys haplostachya* var. *angustifolia*, Cooke's kokio, Mesa Verde cactus, bunched cory cactus, Lloyd's Mariposa cactus, dwarf bear-poppy, Chilean false larch or alerce, *Ancistrocactus tobuschii*, Davis' green pitaya, Nellie cory cactus, Sneed pincushion cactus, spineless hedgehog cactus, Guatemalan fir or pinabeta. Some populations of the American alligator have been reclassified and all the non-U.S. populations of the American crocodile were added to the previously listed U.S. population. The following captive self-sustaining populations of species have been removed from the list (*see* the September 17, 1979, Federal Register (44 FR 54007)): jaguar, black lemur, ring-tailed lemur, leopard, tiger, brown eared pheasant, Edward's pheasant, bar-tailed pheasant, Mikado pheasant, Palawan peacock pheasant, Swinhoe's pheasant.

Since the republication of the lists is a consolidation of previous rules, and the technical changes are purely to aid the reader, this document is not a rule as contemplated under Executive Order 12044 and 43 CFR 14.2(e). Therefore, the provisions of that rule do not apply, and a determination of significance is not required. In addition, the Service finds for good cause that this document shall be effective as indicated above and that notice and public comment are unnecessary. Technical errors detected in previous lists and the **Federal Register** of February 27, 1980 (45 FR 13010–13026, to be codified at 50 CFR §§ 17.11 and 17.12), have been corrected. Some scientific names have been changed to reflect current usage. Synonyms or alternative names are indicated by (=). Readers are requested to advise the Service of any errors, particularly with regard to the historic ranges of the listed taxa.

Dated: May 14, 1980.

Lynn A. Greenwalt,
Director, Fish and Wildlife Service.

Regulations Promulgation

Accordingly, §§ 17.11 and 17.12 are revised and republished to Title 50 of the Code of Federal Regulations as set forth below:

PART 17—ENDANGERED AND THREATENED WILDLIFE AND PLANTS

1. 50 CFR 17.11 and 17.12 are revised to read as follows:

§ 17.11 Endangered and threatened wildlife.

(a) The list in this section contains the names of all species of wildlife which have been determined by the Director to be Endangered or Threatened. It also contains the names of species of wildlife treated as Endangered or Threatened because they are sufficiently similar in appearance to Endangered or Threatened species (see § 17.50 *et seq.*).

(b) The columns entitled "Common Name", "Scientific Name", and "Vertebrate Population where Endangered or Threatened" define the species of wildlife within the meaning of the Act. Thus, differently classified geographic populations of the same vertebrate subspecies or species shall be identified by their differing geographic boundaries, even though the other two columns are identical. The term "Entire" means that all populations throughout the present range of a vertebrate species are listed. Although common names are included, they cannot be relied upon for identification of any specimen, since they may vary greatly in local usage. The Director shall use the most recently accepted scientific name. In cases in which confusion might arise, a synonym will be provided in parentheses. The Services shall rely to the extent practicable on the *International Code of Zoological Nomenclature.*

(c) In the "Status" column the following symbols are used: "E" for Endangered, "T" for Threatened, and "E [or T] (S/A)" for similarity of appearance species.

(d) For information purposes only, the "Historic Range" indicates the general known distribution of the species or subspecies as reported in the scientific literature. The present distribution may be greatly reduced from this historic range. This column does not imply any limitation on the application of the prohibitions in the Act or implementing rules. Such prohibitions apply to all

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individuals of the species, wherever found. When the list is updated annually any change in the range will be added.

(e) For informational purposes only, a footnote to the Federal Register publication(s) originally listing a species is provided under the column "When Listed." Footnote numbers to §§ 17.11 and 17.12 are in the same numerical sequence, since plants and animals may be listed in the same Federal Register document. That document includes a statement indicating the basis for the listing.

(f) The "Special Rules" and "Critical Habitat" columns provide a cross-reference to other sections in Part 17 or Parts 222, 226 or 227. The term "N/A" (not applicable) appearing in either of these two columns indicates that there are no special rules and/or Critical Habitat for that particular species. However, all other appropriate rules in Part 17 and Parts 217–227 and 402 still apply to that species. In addition, there may be other rules in this Title 50 that relate to such wildlife, e.g., port-of-entry requirements. It is not intended that the references in the "Special Rules" column list all the regulations of the two Services which might apply to the species or to the regulations of other Federal agencies or State or local governments.

(g) The listing of a particular taxon includes all lower taxonomic units. For example, the genus *Hylobates* (gibbons) is listed as Endangered throughout its entire range (China, India, and SE Asia); consequently, all species, subspecies, and populations of that genus are considered listed as Endangered for the purposes of the Act. In 1978 (43 FR 6230–6233) the species *Haliaeetus leucocephalus* (bald eagle) was listed as Threatened in "USA (WA, OR, MN, WI, MI)" rather than its entire population; thus, all individuals of the bald eagle found in those five States are considered listed as Threatened for the purposes of the Act.

(h) The "List of Endangered and Threatened Wildlife" is provided below:

SYNOPSIS OF 50 CFR PART 17 LISTS OF ENDANGERED AND THREATENED SPECIES

17.11 - Endangered and Threatened Wildlife

Species		Range			
Common Name	Scientific Name	Historic Range	Portion of Range Where Threatened or Endangered	Status	Special Rules
MAMMALS:					
Bat, gray	Myotis grisescens	Central and Southeastern USA	Entire	E	NA
Bat, Hawaiian hoary	Lasiurus cinereus semotus	USA (Hawaii)	Entire	E	NA
Bat, Indiana	Myotis sodalis	East and Midwestern USA	Entire	E	NA
Bat, Ozark big-eared	Plecotus townsendii ingens	USA (MO, OK, AR)	Entire	E	NA
Bat, Virginia big-eared	Plecotus townsendii virginianus	USA (KY, WV, VA, IN, IL, OH)	Entire	E	NA
Bear, brown or grizzly	Ursus arctos horribilis	Canada and Western USA	USA - 48 contiguous states	T	17.40 (b)
Cougar, eastern	Felis concolor couguar	Eastern North America	Entire	E	NA
Deer, Columbian white-tailed	Odocoileus virginianus leucurus	USA (Washington, Oregon)	Entire	E	NA
Deer, key	Odocoileus virginianus clavium	USA (Southern Florida)	Entire	E	NA
Ferret, black-footed	Mustela nigripes	USA (Western), Western Canada	Entire	E	NA
Fox, Northern Swift	Vulpes velox hebes	USA (Northern Plains), Canada	Entire	E	NA
Fox, San Joaquin kit	Vulpes macrotis mutica	USA (California)	Entire	E	NA
Jaguarundi	Felis yagouaroundi cacomitli	USA (Texas), Mexico	Entire	E	NA
Jaguarundi	Felis yagouaroundi tolteca	USA (Arizona), Mexico	Entire	E	NA
Manatee, West Indian (Florida)	Trichechus manatus	USA (Southeastern), Caribbean Ocean, South America	Entire	E	NA
Mouse, salt marsh harvest	Reithrodontomys raviventris	USA (California)	Entire	E	NA
Otter, southern sea	Enhydra lutris nereis	West Coast USA (Washintgon), south to Mexico	Entire	T	NA
Panther, Florida	Felis concolor coryi	USA (LA and AR east to SC and FL)	Entire	E	NA
Prairie dog, Utah	Cynomys parvidens	USA (Utah)	Entire	E	NA

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(continued)

SYNOPSIS OF 50 CFR PART 17 LISTS OF ENDANGERED AND THREATENED SPECIES
(continued)

17.11 - Endangered and Threatened Wildlife

Species		Range			
Common Name	Scientific Name	Historic Range	Portion of Range Where Threatened or Endangered	Status	Special Rules
MAMMALS (continued)					
Pronghorn, Sonoran	Antilocapra americana sonoriensis	USA (Arizona), Mexico	Entire	E	NA
Rat, Morro Bay kangaroo	Dipodomys heermanni morroensis	USA (California)	Entire	E	NA
Seal, Hawaiian monk	Monachus schauinslandi	Hawaiian Archipelago	Entire	E	NA
Squirrel, Delmarva Peninsula fox	Sciurus niger cinereus	USA (Delmarva Peninsula to Southeast PA)	Entire	E	NA
Wolf, gray	Canis lupus	Holartic	USA (48 contiguous states other than Minnesota)	E	NA
Wolf, gray	Canis lupus	Northern Minnesota	Entire	T	17.40 (d)
Wolf, red	Canis rufus	Southeast USA west to Central Texas	Entire	E	NA
BIRDS:					
Akepa, Hawaii (honeycreeper)	Loxops coccinea coccinea	USA (Hawaii)	Entire	E	NA
Akepa, Maui (honeycreeper)	Loxops coccinea ochracea	USA (Hawaii)	Entire	E	NA
Akialoa, Kauai (honeycreeper)	Hemignathus procerus	USA (Hawaii)	Entire	E	NA
Akiapolaau (honeycreeper)	Hemignathus wilsoni	USA (Hawaii)	Entire	E	NA
Blackbird, yellow-shouldered	Agelaius xanthomus	USA (Puerto Rico)	Entire	E	NA
Bobwhite, masked (quail)	Colinus virginianus ridgwayi	USA (Arizona), Mexico (Sonora)	Entire	E	NA
Condor, California	Gymnogyps californianus	USA (OR, CA), Mexico (Baja California)	Entire	E	NA
Coot, Hawaiian	Fulica americana alai	USA (Hawaii)	Entire	E	NA
Crane, Mississippi sandhill	Grus canadensis pulla	USA (Mississippi)	Entire	E	NA
Crane, whooping	Grus americana	Canada, USA (Rocky Mountains east to Carolinas)	Entire	E	NA

(continued)

SYNOPSIS OF 50 CFR PART 17 LISTS OF ENDANGERED AND THREATENED SPECIES
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17.11 - Endangered and Threatened Wildlife

Species		Range			
Common Name	Scientific Name	Historic Range	Portion of Range Where Threatened or Endangered	Status	Special Rules
BIRDS (continued)					
Creeper, Hawaiian	Loxops maculata mana	USA (Hawaii)	Entire	E	NA
Creeper, Molokai (Kakawahie)	Loxops maculata flammea	USA (Hawaii)	Entire	E	NA
Creeper, Oahu (Alauwahio)	Loxops maculata maculata	USA (Hawaii)	Entire	E	NA
Crow, Hawaiian (Alala)	Corvus tropicus	USA (Hawaii)	Entire	E	NA
Curlew, Eskimo	Numenius borealis	Alaska to Argentina	Entire	E	NA
Dove, Palau ground	Gallicolumba canifrons	West Pacific Ocean: USA (Palau Islands)	Entire	E	NA
Duck, Hawaiian (Koloa)	Anas wyvilliana	USA (Hawaii	Entire	E	NA
Duck, Laysan	Anas laysanensis	USA (Hawaii)	Entire	E	NA
Eagle, bald	Haliaeetus leucocephalus	North America south to Northern Mexico	USA (contiguous states other than WA, OR, MN, WI, MI)	E	NA
Eagle, bald	Haliaeetus leucocephalus	North America south to Northern Mexico	USA (WA, OR, MN, WI, MI)	T	17.41 (a)
Falcon, American peregrine	Falco peregrinus anatum	Canada, USA, Mexico	Entire	E	NA
Falcon,, Arctic peregrine	Falco peregrinus tundrius	Alaska to Greenland, south to South America	Entire	E	NA
Finch, Laysan (honeycreeper)	Telespyza (=Psittirostra) cantans	USA (Hawaii)	Entire	E	NA
Finch, Nihoa (honeycreeper)	Telespyza (=Psittirostra) ultima	USA (Hawaii)	Entire	E	NA
Flycatcher, Tinian monarch	Monarcha takatsukasae	Western Pacific Ocean: USA	Entire	E	NA
Gallinule, Hawaiian	Gallinula chloropus sandvicensis	USA (Hawaii)	Entire	E	NA
Goose, Aleutian Canada	Branta canadensis leucopareia	Western USA (AK, WA, OR, CA)	Entire	E	NA
Goose, Hawaiian (Nene)	Branta sandvicensis	USA (Hawaii)	Entire	E	NA

(continued)

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17.11 - Endangered and Threatened Wildlife

Species		Range			
Common Name	Scientific Name	Historic Range	Portion of Range Where Threatened or Endangered	Status	Special Rules
BIRDS (continued)					
Hawk, Hawaiian (Io)	Buteo solitarius	USA (Hawaii)	Entire	E	NA
Honeycreeper, crested (Akohekohe)	Palmeria dolei	USA (Hawaii)	Entire	E	NA
Kite, Everglade (snail kite)	Rostrhamus sociabilis plumbeus	USA (Florida)	Entire	E	NA
Megapode, La Perouse's	Megapodius laperouse	Western Pacific Ocean: USA (Palau Islands, Marianas Islands)	Entire	E	NA
Millerbird, Nihoa (willow warbler)	Acrocephalus familiaris kingi	USA (Hawaii)	Entire	E	NA
Nukupuu (honeycreeper)	Hemignathus lucidus	USA (Hawaii)	Entire	E	NA
Oo, Kauai (honeyeater)	Moho braccatus	USA (Hawaii)	Entire	E	NA
Ou (honeycreeper)	Psittirostra psittacea	USA (Hawaii)	Entire	E	NA
Owl, Palau	Otus podargina	Western Pacific Ocean: USA (Palau Islands)	Entire	E	NA
Palila (honeycreeper)	Psittirostra bailleui	USA (Hawaii)	Entire	E	NA
Parrot, Puerto Rican	Amazona vittata	USA (Puerto Rico)	Entire	E	NA
Parrotbill, Maui (honeycreeper)	Pseudonestor xanthophrys	USA (Hawaii)	Entire	E	NA
Pelican, brown	Pelecanus occidentalis occidentalis	USA (Carolinas to Texas, California)	Entire	E	NA
Petrel, Hawaiian dark-rumped	Pterodroma phaeopygia sandwichensis	USA (Hawaii)	Entire	E	NA
Pigeon, Puerto Rican plain	Columba inornata wetmorei	USA (Puerto Rico)	Entire	E	NA
Poo-uli	Melamprosops phaeosoma	USA (Hawaii)	Entire	E	NA

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SYNOPSIS OF 50 CFR PART 17 LISTS OF ENDANGERED AND THREATENED SPECIES
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17.11 - Endangered and Threatened Wildlife

Species		Range			
Common Name	Scientific Name	Historic Range	Portion of Range Where Threatened or Endangered	Status	Special Rules
BIRDS (continued)					
Prairie chicken, Attwater's greater	Tympanuchus cupido attwateri	USA (Texas)	Entire	E	NA
Rail, California clapper	Rallus longirostris obsoletus	USA (California)	Entire	E	NA
Rail, light-footed clapper	Rallus longirostris levipes	USA (California), Mexico (Baja California)	Entire	E	NA
Rail, Yuma clapper	Rallus longirostris yumanensis	Mexico (Sonora), USA (Arizona, California)	Entire	E	NA
Shearwater, Newell's Manx	Puffinus puffinus newelli	USA (Hawaii)	Entire	T	NA
Shrike, San Clemente loggerhead	Lanius ludovicianus mearnsi	USA (California)	Entire	E	NA
Sparrow, Cape Sable seaside	Ammospiza maritima mirabilis	USA (Florida)	Entire	E	NA
Sparrow, dusky seaside	Ammospiza maritima nigrescens	USA (Florida)	Entire	E	NA
Sparrow, San Clemente sage	Amphispiza belli clementae	USA (California)	Entire	T	NA
Sparrow, Santa Barbara song	Melospiza melodia graminea	USA (California)	Entire	E	NA
Starling, Ponape mountain	Aplonis pelzelni	Western Pacific Ocean: USA (Caroline Islands)	Entire	E	NA
Stilt, Hawaiian	Himantopus himantopus knudseni	USA (Hawaii)	Entire	E	NA
Tern, California least	Sterna albifrons browni	Mexico, USA (California)	Entire	E	NA
Thrush, large Kauai	Phaeornis obscurus myadestina	USA (Hawaii)	Entire	E	NA
Thrush, Molokai (Olomau)	Phaeornis obscurus rutha	USA (Hawaii)	Entire	E	NA
Thrush, small Kauai (Puaiohi)	Phaeornis palmeri	USA (Hawaii)	Entire	E	NA
Warbler (wood), Bachman's	Vermivora bachmanii	Cuba, USA (Southeastern)	Entire	E	NA

(continued)

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SYNOPSIS OF 50 CFR PART 17 LISTS OF ENDANGERED AND THREATENED SPECIES
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17.11 - Endangered and Threatened Wildlife

Species		Range			
Common Name	Scientific Name	Historic Range	Portion of Range Where Threatened or Endangered	Status	Special Rules
BIRDS (continued)					
Warbler (wood), Kirtland's	*Dendroica kirtlandii*	USA (principally Michigan)	Entire	E	NA
Whippoorwill, Puerto Rican	*Caprimulgus noctitherus*	USA (Puerto Rico)	Entire	E	NA
White-eye, Ponape great	*Rukia sanfordi*	Western Pacific Ocean: USA (Caroline Islands)	Entire	E	NA
Woodpecker, ivory-billed	*Campephilus principalis*	Cuba, USA (Southcentral and Southeastern)			
Woodpecker, red-cockaded	*Picoides (=Dendrocopos) borealis*	USA (Southcentral and Southeastern)	Entire	E	NA
REPTILES:					
Alligator, American	*Alligator mississippiensis*	Southeastern USA	Wherever found, except for those areas listed below	E	NA
Alligator, American	*Alligator mississippiensis*	Southeastern USA	In the wild in Florida and in certain areas of Georgia, Louisiana, South Carolina, and Texas	T	17.42 (a)
Alligator, American	*Alligator mississippiensis*	Southeastern USA	In the wild in Louisiana (Cameron, St. Mary, Vermillion, Iberia, Terrebonne, St. Charles, La Fourche, St. Bernard, St. Tammany, Jefferson, Calcasieu and Plaquemines parishes)	T (S/A)	17.42(a)
Anole, Culebra giant	*Anolis roosevelti*	USA (Puerto Rico: Culebra Island)	Entire	E	NA
Boa, Mona	*Epicrates monensis monensis*	USA (Puerto Rico)	Entire	T	NA

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SYNOPSIS OF 50 CFR PART 17 LISTS OF ENDANGERED AND THREATENED SPECIES
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17.11 - Endangered and Threatened Wildlife

Species		Range			
Common Name	Scientific Name	Historic Range	Portion of Range Where Threatened or Endangered	Status	Special Rules
REPTILES (continued)					
Boa, Puerto Rico	Epicrates inornatus	USA (Puerto Rico)	Entire	E	NA
Boa, Virgin Islands tree	Epicrates monensis granti	U.S. and British Virgin Islands	Entire	E	NA
Crocodile, American	Crocodylus acutus	USA (South Florida and Florida keys)	Entire	E	NA
Iguana, Mona ground	Cyclura stejnegeri	USA (Puerto Rico: Mona Island)	Entire	T	NA
Lizard, blunt-nosed leopard	Crotaphytus silus	USA (California)	Entire	E	NA
Lizard, Island night	Klauberina riversiana	USA (California)	Entire	T	NA
Lizard, St. Croix ground	Ameiva polops	USA (Virgin Islands: Green Cay, Protestant Cay)	Entire	E	NA
Rattlesnake, New Mexican ridge-nosed	Crotalus willardi obscurus	USA (New Mexico), Mexico	Entire	T	NA
Snake, Atlantic salt marsh	Nerodia fasciata taeniata	USA (Florida)	Entire	T	NA
Snake, eastern indigo	Drymarchon corais couperi	USA (FL, GA, MS, SC, AL)	Entire	T	NA
Snake, San Francisco garter	Thamnophis sirtalis tetrataenia	USA (California)	Entire	E	NA
Turtle, green sea	Chelonia mydas	Circumglobal in tropical and temperate seas and oceans	Breeding colony populations in Florida	E	NA
Turtle, Plymouth red-bellied	Chrysemys rubriventris bangsi	USA (Massachusetts)	Entire	E	NA
AMPHIBIANS:					
Coqui, golden	Eleutherodactylus jasperi	USA (Puerto Rico)	Entire	T	NA
Salamander, desert slender	Batrachoseps aridus	USA (California)	Entire	E	NA

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SYNOPSIS OF 50 CFR PART 17 LISTS OF ENDANGERED AND THREATENED SPECIES
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17.11 - Endangered and Threatened Wildlife

Species		Range			
Common Name	Scientific Name	Historic Range	Portion of Range Where Threatened or Endangered	Status	Special Rules
AMPHIBIANS (continued)					
Salamander, Red Hills	Phaeognathus hubrichti	USA (Alabama)	Entire	T	NA
Salamander, Santa Cruz long-toed	Ambystoma macrodactylum croceum	USA (California)	Entire	E	NA
Salamander, Texas blind	Typhlomolge rathbuni	USA (Texas)	Entire	E	NA
Toad, Houston	Bufo houstonensis	USA (Texas)	Entire	E	NA
Treefrog, Pine Barrens	Hyla andersonii	USA (FL, AL, NC, SC, NJ)	Florida	E	NA
FISHES:					
Bonytail, Pahranagat	Gila robusta jordani	USA (Nevada)	Entire	E	NA
Cavefish, Alabama	Speoplatyrhinus poulsoni	USA (Alabama)	Entire	T	NA
Chub, bonytail	Gila elegans	USA (A, CA, CO, NV, UT, WY)			
Chub, humpback	Gila cypha	USA (AZ, UT, WY)	Entire	E	NA
Chub, Mohave	Gila mohavensis	USA (California)	Entire	E	NA
Chub, slender	Hybopsis cahni	USA (TN, VA)	Entire	T	17.4
Chub, spotfin	Hybopsis monacha	USA (VA, TN, NC)	Entire	T	17.44
Cisco, longjaw	Coregonus alpenae	USA (Lakes Michigan, Huron, and Erie)	Entire	E	NA
Cui-ui	Chasmistes cujus	USA (Nevada)	Entire	E	NA
Dace, Kendall Warm Springs	Rhinichthys osculus thermalis	USA (Wyoming)	Entire	E	NA
Dace, Moapa	Moapa coriacea	USA (Nevada)	Entire	E	NA
Darter, bayou	Etheostoma rubrum	USA (Mississippi)	Entire	T	17.44 (b)
Darter, fountain	Etheostoma fonticola	USA (Texas)	Entire	E	NA
Darter, leopard	Percina pantherina	USA (AR, OK)	Entire	T	17.44

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SYNOPSIS OF 50 CFR PART 17 LISTS OF ENDANGERED AND THREATENED SPECIES
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17.11 - Endangered and Threatened Wildlife

Species		Range			
Common Name	Scientific Name	Historic Range	Portion of Range Where Threatened or Endangered	Status	Special Rules
FISHES (continued)					
Darter, Maryland	*Etheostoma sellare*	USA (Maryland)	Entire	E	NA
Darter, Okaloosa	*Etheostoma okaloosae*	USA (Florida)	Entire	E	NA
Darter, slackwater	*Etheostoma boschungi*	USA (Alabama, Tennessee)	Entire	T	17.44
Darter, snail	*Percina tanasi*	USA (Tennessee)	Entire	E	NA
Darter, watercress	*Etheostoma nuchale*	USA (Alabama)	Entire	E	NA
Gambusia, Big Bend	*Gambusia gaigei*	USA (Texas)	Entire	E	NA
Gambusia, Clear Creek	*Gambusia heterochir*	USA (Texas)	Entire	E	NA
Gambusia Goodenough	*Gambusia amistadensis*	USA (Texas)	Entire	E	NA
Gambusia, Pecos	*Gambusia nobilis*	USA (Texas, New Mexico)	Entire	E	NA
Killifish, Pahrump	*Empetrichthys latos*	USA (Nevada)	Entire	E	NA
Madtom, Scioto	*Noturus trautmani*	USA (Ohio)	Entire	E	NA
Madtom, yellow fin	*Noturus flavipinnis*	USA (TN, VA, GA)	Entire	T	17.44 (c)
Pike, blue	*Stizostedion vitreum glaucum*	USA (Lakes Erie and Ontario)	Entire	E	NA
Pupfish, Comanche Springs	*Cyprinodon elegans*	USA (Texas)	Entire	E	NA
Pupfish, Devil's Hole	*Cyprinodon diabolis*	USA (Nevada)	Entire	E	NA
Pupfish, Owens River	*Cyprinodon radiosus*	USA (California)	Entire	E	NA
Pupfish, Tecopa	*Cyprinodon nevadensis calidae*	USA (California)	Entire	E	NA
Pupfish, Warm Springs	*Cyprinodon nevadensis pectoralis*	USA (Nevada)	Entire	E	NA
Squawfish, Colorado River	*Ptychocheilus lucius*	USA (AZ, CA, CO, NV, NM, UT, WY)	Entire	E	NA
Stickleback, unarmored three-spine	*Gasterosteus aculeatus williamsoni*	USA (California)	Entire	E	NA

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SYNOPSIS OF 50 CFR PART 17 LISTS OF ENDANGERED AND THREATENED SPECIES
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17.11 - Endangered and Threatened Wildlife

Species		Range			
Common Name	Scientific Name	Historic Range	Portion of Range Where Threatened or Endangered	Status	Special Rules
FISHES (continued)					
Sturgeon, shortnose	*Acipenser brevirostrum*	USA (Atlantic Coast of US and Canada)	Entire	E	NA
Topminnow, Gila	*Poeciliopsis occidentalis*	USA (AZ, NM), Mexico	Entire	E	NA
Trout, Arizona	*Salmo apache*	USA (Arizona)	Entire	T	17.44 (a)
Trout, Gila	*Salmo gilae*	USA (New Mexico)	Entire	E	NA
Trout, greenback cutthroat	*Salmo clarki stomias*	USA (Colorado)	Entire	T	NA
Trout, Lahontan cutthroat	*Salmo clarki henshawi*	USA (California, Nevada)	Entire	T	17.44 (a)
Trout, Little Kern golden	*Salmo aguabonita whitei*	USA (California)	Entire	T	17.44 (c)
Trout, Paiute cutthroat	*Salmo clarki seleniris*	USA (California)	Entire	T	17.44 (a)
Woundfin	*Plagopterus argentissimus*	USA (Arizona, Nevada, Utah)	Entire	E	NA
SNAILS:					
Snail, Chittenango ovate amber	*Succinea chittenangoensis*	USA (New York)	New York	T	NA
Snail, flat-spired three-toothed	*Triodopsis platysayoides*	USA (West Virginia)	Entire	T	NA
Snail, Iowa Pleistocene	*Discus macclintocki*	USA (Iowa)	Entire	E	NA
Snail, noonday	*Mesodon clarki nantahala*	USA (North Carolina)	Entire	T	NA
Snail, painted snake coiled forest	*Anguispira picta*	USA (Tennessee)	Entire	T	NA
Snail, Stock Island tree	*Orthalicus reses*	USA (Florida)	Entire	T	NA
Snail, Virginia fringed mountain	*Polygyriscus virginianus*	USA (Virginia)	Entire	T	NA

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SYNOPSIS OF 50 CFR PART 17 LISTS OF ENDANGERED AND THREATENED SPECIES
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17.11 - Endangered and Threatened Wildlife

Species		Range			
Common Name	Scientific Name	Historic Range	Portion of Range Where Threatened or Endangered	Status	Special Rules
CLAMS:					
Pearly mussel, Alabama lamp	Lampsilis virescens	USA (Alabama, Tennessee)	Entire	E	NA
Pearly mussel, Appalachian monkey-face	Quadrula sparsa	USA (Virginia, Tennessee)	Entire	E	NA
Pearly mussel, birdwing	Conradilla caelata	USA (Virginia, Tennessee)	Entire	E	NA
Pearly mussel, Cumberland bean	Villosa (=Micromya) trabalis	USA (Kentucky)	Entire	E	NA
Pearly mussel, Cumberland monkey-face	Quadrula intermedia	USA (VA, TN, AL)	Entire	E	NA
Pearly mussel, Curtis	Epioblasma (=Dysnomia) florentina curtisi)	USA (Missouri)	Entire	E	NA
Pearly mussel, dromedary	Dromus dromas	USA (Virginia, Tennessee)	Entire	E	NA
Pearly mussel, green-blossom	Epioblasma (=Dysnomia) torulosa gubernaculus	USA (Virginia, Tennessee)	Entire	E	NA
Pearly mussel, Higgin's eye	Lampsilis higginsi	USA (MN, WI, IL, MO, IA, NE)	Entire	E	NA
Pearly mussel, orange-footed	Plethobasis cooperianus	USA (AL, TN, IN, IA, KY, OH, PA)	Entire	E	NA
Pearly mussel, pale lilliput	Tosolasma (=Carunculina) cylinderella	USA (AL, TN, MO, WV)	Entire	E	NA
Pearly mussel, pink mucket	Lampsilis orbiculata orbiculata	USA (AL, WV, TN, IL, IN, KY, MO, OH, PA)	Entire	E	NA
Pearly mussel, Sampson's	Epioblasma (=Dysnomia) sampsoni	USA (IN, IL)	Entire	E	NA
Pearly mussel, tubercled-blossom	Epioblasma (=Dysnomia) torulosa torulosa	USA (KY, IL, TN, WV)	Entire	E	NA
Pearly mussel, turgid-blossom	Epioblasma (=Dysnomia) turgidula	USA (AL, AR, MO, MN)	Entire	E	NA

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SYNOPSIS OF 50 CFR PART 17 LISTS OF ENDANGERED AND THREATENED SPECIES
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17.11 - Endangered and Threatened Wildlife

Species		Range			
Common Name	Scientific Name	Historic Range	Portion of Range Where Threatened or Endangered	Status	Special Rules
CLAMS (continued)					
Pearly mussel, white cat's eye	Epioblasma (=Dysnomia) sulcata delicata	USA (OH, MI, IN)	Entire	E	NA
Pearly mussel, white wartyback	Plethobasis cicatricosus	USA (Alabama, Tennessee)	Entire	E	NA
Pearly mussel, yellow-blossom	Epioblasma (=Dysnomia) florentina florentina	USA (Alabama, Tennessee)	Entire	E	NA
Pigtoe, fine-rayed	Fusconaia cuneolus	USA (VA, AL, TN)	Entire	E	NA
Pigtoe, rough	Pleurobema plenum	USA (KY, VA, TN)	Entire	E	NA
Pigtoe, shiny	Fusconaia edgariana	USA (VA, AL, TN)	Entire	E	NA
Pocketbook, fat	Potamilus (=Proptera) capax	USA (AR, MO, IN, OH)	Entire	E	NA
Riffle shell clam, tan	Epioblasma walkeri	USA (TN, VA, KY)	Entire	E	NA
CRUSTACEANS:					
Isopod, Socorro	Exosphaeroma thermophilus	USA (New Mexico)	Entire	E	NA
INSECTS:					
Butterfly, Bahama swallowtail	Papilio andraemon bonhotei	USA (Florida), Bahamas	USA	T	17.47
Butterfly, El Segundo blue	Shijimiaeoides battoides allyni	USA (California)	Entire	E	NA
Butterfly, Lange's metalmark	Apodemia mormo langei	USA (California)	Entire	E	NA
Butterfly, Lotis blue	Lycaeides argyrognomon lotis	USA (California)	Entire	E	NA
Butterfly, mission blue	Icaricia icarioides missionensis	USA (California)	Entire	E	NA
Butterfly, San Bruno elfin	Callophrys mossii bayensis	USA (California)	Entire	E	NA

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17.11 - Endangered and Threatened Wildlife

Species		Range			
Common Name	Scientific Name	Historic Range	Portion of Range Where Threatened or Endangered	Status	Special Rules
INSECTS (continued)					
Butterfly, Schaus swallowtail	Papilio aristodemus ponceanus	USA (Florida)	Entire	T	17.47
Butterfly, Smith's blue	Shijimiaeoides enoptes smithi	USA (California)	Entire	E	NA
Moth, kern primrose sphinx	Euproserpinus euterpe	USA (California)	Entire	T	NA
PLANTS:					
	Alismataceae - Waterplantain family:				
Bunched arrowhead	Sagittaria fasciculata	USA (NC, SC)	Entire	E	NA
	Asteraceae - Aster family:				
Tennessee purple coneflower	Echinacea tennesseensis	USA (Tennessee)	Entire	E	NA
None	Lipochaeta venosa	USA (Hawaii)	Entire	E	NA
	Berberidaceae - Barberry family:				
Truckee barberry	Berberis sonnei	USA (California)	Entire	E	NA
	Betulaceae, Birch family:				
Virginia round-leaf birch	Betula uber	USA (Virginia)	Entire	E	NA
	Brassicaceae, Mustard family:				
McDonald's rock cress	Arabis macdonaldiana	USA (California)	Entire	E	NA
Contra Costa wallflower	Erysimum capitatum var. angustatum	USA (California)	Entire	E	NA
	Cactaceae - Cactus family:				
Tobusch fishook cactus	Ancistrocactus tobuschii	USA (Texas)	Entire	E	NA
Nellie cory cactus	Coryphantha minima	USA (Texas)	Entire	E	NA
Bunched cory cactus	Coryphantha ramilosa	USA (Texas)	Entire	T	NA
Lee pincushion cactus	Coryphantha sneedii var. leei	USA (New Mexico)	Entire	T	NA

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SYNOPSIS OF 50 CFR PART 17 LISTS OF ENDANGERED AND THREATENED SPECIES
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17.11 - Endangered and Threatened Wildlife

Species		Range			
Common Name	Scientific Name	Historic Range	Portion of Range Where Threatened or Endangered	Status	Special Rules
PLANTS (continued)					
Sneed pincushion cactus	Coryphantha sneedii var. sneedii	USA (Texas, New Mexico)	Entire	E	NA
Nichol's Turk's head cactus	Echinocactus horizonthalonius var. nicholii	USA (Arizona)	Entire	E	NA
Purple-spined hedgehog cactus	Echinocereus engelmannii var. purpureus	USA (Utah)	Entire	E	NA
Kuenzler hedgehog cactus	Echinocereus kuenzleri	USA (New Mexico)	Entire	E	NA
Lloyds hedgehog cactus	Echinocereus lloydii	USA (Texas)	Entire	E	NA
Black lace cactus	Echinocereus reichenbachii var. albertii	USA (Texas)	Entire	E	NA
Arizona hedgehog cactus	Echinocereus triglochidiatus var. arizonicus	USA (Arizona)	Entire	E	NA
Spineless hedgehog cactus	Echinocereus triglochidiatus var. inermis	USA (Colorado)	Entire	E	NA
David's green pitaya	Echinocereus viridiflorus var. davisii	USA (Texas)	Entire	E	NA
Lloyd's Mariposa cactus	Neolloydia mariposensis	USA (Texas)	Entire	T	NA
Brady pincushion cactus	Pediocactus bradyi	USA (Arizona)	Entire	E	NA
Knowlton cactus	Pediocactus knowltonii	USA (New Mexico)	Entire	E	NA
Peebles Navajo cactus	Pediocactus peeblesianus var. peeblesianus	USA (Arizona)	Entire	E	NA
Silver pincushion cactus	Pediocactus sileri	USA (Arizona, Utah)	Entire	E	NA
Uinta Basin hookless cactus	Sclerocactus glaucus	USA (Colorado, Utah)	Entire	E	NA
Mesa Verde cactus	Sclerocactus mesae-verdae	USA (Colorado, New Mexico)	Entire	T	NA
Wright fishook cactus	Sclerocactus wrightiae	USA (Utah)	Entire	E	NA

(continued)

SYNOPSIS OF 50 CFR PART 17 LISTS OF ENDANGERED AND THREATENED SPECIES
(continued)

17.11 - Endangered and Threatened Wildlife

Species		Range			
Common Name	Scientific Name	Historic Range	Portion of Range Where Threatened or Endangered	Status	Special Rules
PLANTS (continued)					
	Crassulaceae, Stonecrop family:				
Santa Barbara Island liveforever	Dudleya traskiae	USA (California)	Entire	E	NA
	Ericaceae - Heath family:				
Raven's manzanita	Arctostaphylos hookeri ssp. ravenii	USA (California)	Entire	E	NA
Chapman rhododendron	Rhododendron chapmanii	USA (Florida)	Entire	E	NA
	Fabaceae, Pea family:				
Rydberg milk-vetch	Astragalus perianus	USA (Utah)	Entire	T	NA
Hairy rattleweed	Baptisia arachnifera	USA (Georgia)	Entire	E	NA
San Clemente broom	Lotus scoparius ssp. traskiae	USA (California)	Entire	E	NA
Hawaiian wild broadbean	Vicia menziesii	USA (Hawaii)	Entire	E	NA
	Hydrophyllaceae Waterleaf family:				
Unnamed phacelia	Phacelia argillacea	USA (Utah)	Entire	E	NA
	Lamiaceae, Mint family:				
None	Haplostachys haplostachya var. angustifolia	USA (Hawaii)	Entire	E	NA
San Diego mesa mint	Pogogyne abramsii	USA (California)	Entire	E	NA
None	Stenogyne angustifolia var. angustifolia	USA (Hawaii)	Entire	E	NA
	Liliaceae, Lily family:				
Harper's beauty	Harperocallis flava	USA (Florida)	Entire	E	NA
Persistent trillium	Trillium persistens	USA (Georgia, South Carolina)	Entire	E	NA

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(continued)

SYNOPSIS OF 50 CFR PART 17 LISTS OF ENDANGERED AND THREATENED SPECIES
(continued)

17.11 - Endangered and Threatened Wildlife

Species		Range			
Common Name	Scientific Name	Historic Range	Portion of Range Where Threatened or Endangered	Status	Special Rules
PLANTS (continued)					
	Malvaceae, Mallow family:				
Cooke's kokio	Kokia cookei	USA (Hawaii)	Entire	E	NA
San Clemente Island bushmallow	Malacothamnus clementinus	USA (California)	Entire	E	NA
	Nyctaginaceae - Four o'clock family:				
MacFarlane's four-o'clock	Mirabilis macfarlanei	USA (Idaho, Oregon)	Entire	E	NA
	Onagraceae, Evening primrose family:				
Eureka evening-primrose	Oenothera avita ssp. eurekensis	USA (California)	Entire	E	NA
Antioch Dunes evening primrose	Oenothera deltoides ssp. howellii	USA (California)	Entire	E	NA
	Papaveraceae - Poppy family:				
Dwarf bear-poppy	Arctomecon humilis	USA (Utah)	Entire	E	NA
	Poaceae, Grass family:				
Solano (=Crampton's orcutt) grass	Orcuttia mucronata	USA (California)	Entire	E	NA
Eureka dune grass	Swallenia alexandrae	USA (California)	Entire	E	NA
Texas wild-rice	Zizania texana	USA (Texas)	Entire	E	NA
	Ranunculaceae, Buttercup family:				
Northern wild monkshood	Aconitum noveboracense	USA (California)	Entire	T	NA
San Clemente Island larkspur	Delphinium kinkiense	USA (California)	Entire	T	NA

(continued)

SYNOPSIS OF 50 CFR PART 17 LISTS OF ENDANGERED AND THREATENED SPECIES
(continued)

17.11 - Endangered and Threatened Wildlife

Species		Range			
Common Name	Scientific Name	Historic Range	Portion of Range Where Threatened or Endangered	Status	Special Rules
PLANTS (continued)					
	Sarraceniaceae - Pitcherplant family:				
Green pitcherplant	*Sarracenia oreophila*	USA (Alabama, Georgia)	Entire	E	NA
	Scrophulariaceae, Snapdragon family:				
San Clemente Island paint-brush	*Castilleja grisea*	USA (California)	Entire	E	NA
Salt marsh bird's beak	*Cordylanthus maritimus ssp. maritimus*	USA (California), Mexico	Entire	E	NA
Furbish lousewort	*Pedicularis furbishiae*	USA (Maine), Canada (New Brunswick)	Entire	E	NA

APPENDIX 5-B

CRITICAL HABITATS

CRITICAL HABITATS

Species	Date of Federal Register
Indiana bat	9/24/76
Virginia big-eared bat	11/30/79
Florida manatee	9/24/78
Morro Bay kangaroo rat	8/11/77
Gray wolf	3/9/78
Yellow-shouldered blackbird	11/19/76
California condor	9/24/76
Mississippi sandhill crane	8/8/77
Whooping crane	5/15/78
American peregrine falcon	8/11/77
Everglade kite	8/11/77
Palila (honey creeper)	8/11/77
Cape Sable seaside sparrow	8/11/77
Dusky seaside sparrow	8/11/77
Giant Culebra anole	7/21/77
Mona boa	2/3/78
American crocodile	9/24/76
Mona ground iguana	2/3/78
St. Croix ground lizard	6/3/77
New Mexico ridge-nosed rattlesnake	8/4/78
Leatherback sea turtle	9/26/78
Plymouth red-bellied turtle	4/8/80
Golden coqui	11/11/77
Houston toad	1/31/78
Pine barrens treefrog	11/11/77
Alabama cavefish	9/9/77
Slender chub	9/9/77

(continued)

CRITICAL HABITATS
(continued)

Species	Date of Federal Register
Spotfin chub	9/9/77
Fountain darter	1/27/78
Leopard darter	1/27/78
Little Kern golden trout	4/13/78
Conta Costa wallflower	8/31/78
Antioch Dune evening primrose	8/31/78

CHAPTER 5

ENDANGERED SPECIES

Criterion Compliance Decision

☐ *Does Not Require Further Evaluation*

☐ *Does Not Comply*

1. Are any endangered or threatened species as listed pursuant to the Endangered Species Act of 1973 (16 U.S.C. 1530 et. seq. as amended) in 50 CFR Part 17 likely to be affected by the facility?

☐ YES (continue to 2)

☐ Facility is within the range or area of known occurrence of an endangered or threatened species. List species: ______________________

☐ NO (*DOES NOT REQUIRE FURTHER EVALUATION*)

2. Does the facility result in the destruction or adverse modification of a critical habitat as identified in 50 CFR Part 17?

☐ YES (*DOES NOT COMPLY* - continue to 3)

Factors considered:

Type of critical habitat ______________________
Size of critical habitat ______________________
Sensitivity of critical habitat to adverse impacts caused by facility ______________________
Critical habitat species characteristics ______________________
Proximity of facility to critical habitat ______________________
Facility design and operational characteristics ______________________

☐ NO (continue to 3)

- ☐ Facility is not in a critical habitat
- ☐ Facility has passed assessment made by State, according to facility records
- ☐ Facility has passed assessment made by CES or other Federal agency
- ☐ Facility has an individual 404 Permit with an assessment section
- ☐ Nearby assessments have indicated comparable situation at facility is not a problem
- ☐ Facility has passed State assessment considering list of factors mentioned above

CHAPTER 5

ENDANGERED SPECIES

(continued)

3. Does the facility cause or contribute to the taking of any endangered or threatened species of plants, fish, or wildlife?

☐ YES (*DOES NOT COMPLY*)

☐ Facility resulted in destruction or adverse modification of a critical habitat. Species involved ____________________

☐ Facility was assessed by State for a "taking"

Factors considered:

Type of species and species habitat ____________________

Species characteristics ____________________

____

Sensitivity of species and species habitat to adverse impacts ________

____

Proximity of facility ____________________

Facility size, design, and operational characteristics ________

____

____

Adverse impacts considered:

Harassing, harming, pursuing, hunting, wounding, killing, trapping, capturing, or collecting species (direct violation of ESA, *does not comply*) ____________________

Adverse modification or loss of habitat (including air and water pollution) ____________________

____

Infringement on breeding, nesting, and feeding activities ________

____

Interference with species movement ____________________

____

☐ NO (*DOES NOT REQUIRE FURTHER EVALUATION*)

☐ Facility meets the following three requirements

- ☐ facility has no record of taking an endangered or threatened species
- ☐ facility does not violate Air, Surface Water, Floodplains, or Disease Criteria
- ☐ facility and immediate area are not inhabited by any endangered or threatened species

☐ Facility passes State assessment for a "taking"

- ☐ partial assessment of one or more criteria areas where facility meets the first and third of the above three requirements
- ☐ full assessment considering factors and adverse impacts described previously

CHAPTER 6(a)

DISEASE: VECTORS

1.0 Criterion and Definitions

(a) *Disease Vectors.* The facility or practice shall not exist or occur unless the on-site population of disease vectors is minimized through the periodic application of cover material or other techniques as appropriate so as to protect public health.

(c) As used in this section:

(2) "Disease vector" means rodents, flies, and mosquitoes capable of transmitting disease to humans.

(3) "Incorporated into the soil" means the injection of solid waste beneath the surface of the soil or the mixing of solid waste with the surface soil.

(4) "Periodic application of cover material" means the application and compaction of soil or other suitable material over disposed solid waste at the end of each operating day or at such frequencies and in such a manner as to reduce the risk of fire and to impede vectors' access to the waste.

2.0 Inventory Procedure

The evaluation approach is predicated on the concept that periodic application of cover material must be employed or other appropriate techniques must be used to minimize the on-site population of disease vectors. Additionally, the evaluation is to be based on the use of daily cover unless the nature of the waste received does not warrant such frequency (e.g., demolition wastes). The State agency conducting the Inventory evaluation must judge the adequacy of cover practices or other control techniques for each specific facility based on the history of operation and field inspection. Consultation with local health authorities is encouraged.

Guidance is provided as follows:

(a) For rodents and flies, procedures to evaluate landfills and landspreading facilities are discussed. Rodents and flies are not of concern at surface impoundments containing only non-putrescible wastes because they are not attracted to such facilities. For purposes of the Inventory, the rodent of primary concern is the rat, although squirrels are known to carry plague on the Colorado Plateau.

(b) For mosquitoes, procedures for evaluation of all three facility types are discussed.

(c) Facilities which landspread sewage sludge or septic tank pumpings must also be evaluated against Section 257.3-6(b) of the Criteria as discussed in Section 6(b) of this manual.

The decision flow chart is presented in Figure 6(a)-1.

2.1 Definitions

"Putrescible wastes" means solid waste which contains organic matter capable of being decomposed by microorganisms and of such a character and proportion as to be capable of attracting or providing food for disease vectors.

3.0 Resolution of Decision Flow Chart Question

3.1 Does the facility minimize the on-site population of disease vectors through the periodic application of cover material or other techniques if appropriate so as to protect public health?

(a) Rats and Flies

(1) Landfills

- Rats and flies are only of concern at facilities which accept wastes attractive to these vectors. If a facility does not accept putrescible wastes and is not a breeding ground or habitat for rats or flies, the evaluation can proceed to address mosquitoes as discussed in Section 3.1(b).

- For facilities which accept putrescible wastes, the primary control technique is the application of daily cover material. To determine if the facility practices this technique, it will be necessary to assess the history of the facility through records of inspections and complaints and to make a field inspection. If both

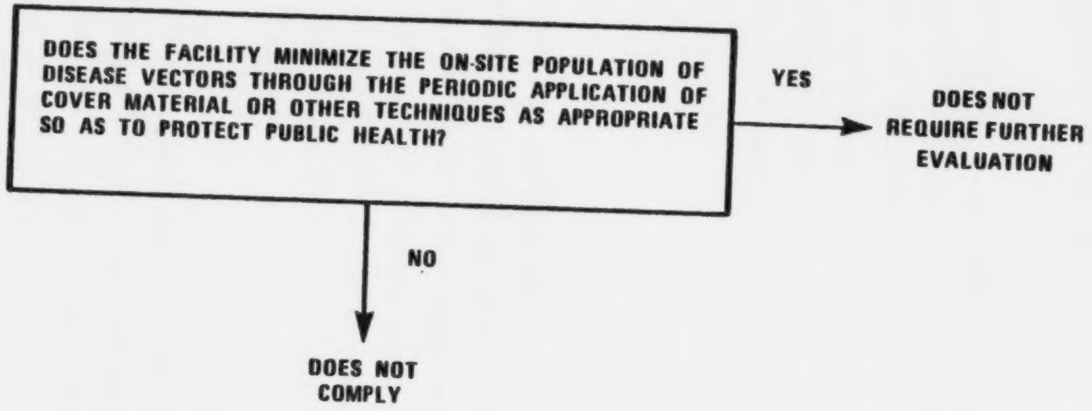
DOES THE FACILITY MINIMIZE THE ON-SITE POPULATION OF DISEASE VECTORS THROUGH THE PERIODIC APPLICATION OF COVER MATERIAL OR OTHER TECHNIQUES AS APPROPRIATE SO AS TO PROTECT PUBLIC HEALTH?
YES
DOES NOT REQUIRE FURTHER EVALUATION
NO
DOES NOT COMPLY

FIGURE 6(a)-1 FLOW CHART–DISEASE VECTORS the records and the field inspection indicate that daily cover is being practiced, the evaluation can proceed to address mosquitoes as discussed in Section 3.1(b). The State can determine that the application of adequate cover is being practiced even if during certain times of the year cover is applied less frequently than daily due to severe weather conditions.

- If the cover practice is less than daily (or in the case of a surface impoundment containing putrescible waste), then other techniques must be employed so as to minimize the on-site population of rats and flies. The State must determine whether the techniques employed are appropriate and effective. Such techniques may include:

  repellants,
  insecticides or rodenticides,
  composting or processing,
  predatory or reproductive control.

The State may wish to utilize the services and expertise of a qualified professional such as a health officer to assist in deciding whether rats and/or flies are present at a facility and whether the facility is minimizing the on-site population of these vectors. The State and local health department are likely sources of such trained experienced personnel. In some cases, a qualified consultant may be required.

- If the cover practice is less than daily due to conditions other than weather, and the above techniques are not used or are determined by the State to be insufficient to minimize the rats and flies at the facility, *the facility does not comply.*

(2) Landspreading

If only non-putrescible wastes are being applied, the evaluation can proceed to address mosquitoes as discussed in Section 3.1(b).

When putrescible wastes are landspread there is a potential for the attraction of rats and flies. The first step in evaluating facilities that landspread putrescible waste is to determine whether the waste is incorporated into the soil; this is the preferred method of controlling these vectors. Incorporating the waste into the soil entails the injection of the waste below the surface of the soil or mixing the waste with the surface soil. This practice serves to reduce the availability of the waste to vectors, thereby reducing the attraction of vectors. In some cases, treatment of the waste may be acceptable in lieu of incorporation. Treatment processes such as biological digestion or composting can render the material less attractive to vectors. Rodenticides and insecticides may also be effective at such facilities.

The actual determination of the presence of rats and flies should be made by inspecting the facility for evidence of these vectors and evaluating past inspection and complaint records. If the waste is incorporated and/or treated sufficiently or if there is no evidence of these vectors, the evaluation can proceed to address mosquitoes as discussed in Section 3.1(b). If the on-site population of rats or flies is not minimized as appropriate to protect public health, *the facility does not comply*.

(3) Surface Impoundments

Although rats and flies are not normally attracted to surface impoundments, the State may wish to evaluate these facilities for the presence of either or both of these two vector types. If only non-putrescible wastes are contained in the surface impoundment, the evaluation can proceed to address moquitoes as discussed in Section 3.1(b).

Surface impoundments containing putrescible wastes may attract rats and flies. Rodenticides and insecticides may be useful controls at such facilities. These facilities are evaluated by examining past inspection and complaint records and conducting a field inspection. The services of a qualified professional may be appropriate.

If no vector population exists or if the facility practices a technique which controls these vectors to the satisfaction of the State, the evaluation can proceed to address mosquitoes as discussed in Section 3.1(b).

(b) Mosquitoes

(1) Landfills and Landspreading Facilities

The presence of standing water is the only mosquito attractant associated with landfills and landspreading facilities. If water is allowed to stand for more than three days, mosquitoes will have sufficient time to complete their breeding cycle. Places where water will tend to collect include:

- depressions over the surface,
- open containers,
- tires stored in a separate area of the fill,
- ponds from excavating soil,
- leachate storage, and
- siltation basins.

If a facility is operated so as to minimize standing water, mosquitoes will be controlled and *the facility does not require further evaluation*. Facilities with standing water must be evaluated further to determine if an insecticide spraying program exists which the State determines is sufficient to minimize the mosquito population so as to protect the public health. If the State determines that the standing water supports a population of mosquito larvae, and that the resultant population of adult mosquitoes is not adequately minimized through a control program, then *the facility does not comply.*

(2) Surface Impoundments

A surface impoundment can be a breeding site for mosquitoes. If present, the larve will be found near the edge of the impoundment, near vegetation, or near organic debris. The mosquito population can be minimized by operational controls such as agitating the surface or varying the level of the water. Sometimes other aquatic organisms exist which feed on mosquito larvae or compete for food, thereby restricting the vector population. Adult mosquitoes can also be controlled with an insecticide program. *The facility does not require further evaluation* if mosquito larvae are not observed at the facility or the mosquito population is minimized by the above techniques to the satisfaction of the State. *The facility does not comply* if the State determines it to pose a public health problem due to the mosquito population.

CHAPTER 6(a)

DISEASE: VECTORS

Criterion Compliance Decision

☐ *Does not Require Further Evaluation*

☐ *Does Not Comply*

Does the facility minimize the on-site population of disease vectors through the periodic application of cover material or other techniques as appropriate so as to protect public health?

☐ YES *(DOES NOT REQUIRE FURTHER EVALUATION)*

Rats and Flies

Landfills

- ☐ Facility applies daily cover
- ☐ Facility does not apply daily cover, but satisfactorily employs other techniques such as:
  - ☐ Repellants ______________________
  - ☐ Insecticides or rodenticides ______________________
  - ☐ Composting or processing ______________________
  - ☐ Predatory or reproductive control ______________________

Landspreading

- ☐ Non-putrescible wastes only
- ☐ Putrescible wastes are incorporated into the soil or treated
- ☐ Effective rodenticide or insecticide program
- ☐ No evidence of vectors

Surface Impoundments

- ☐ Non-putrescible wastes only
- ☐ Effective rodenticide or insecticide program
- ☐ No evidence of vectors

Mosquitoes

Landfills and Landspreading

- ☐ No presence or potential for standing water
- ☐ Effective insecticide program
- ☐ Facility provides environmental control techniques
  - ☐ Varying water level
  - ☐ Agitation of water
  - ☐ Presence of aquatic life which feed on mosquito larvae
- ☐ No visual observation of mosquito larvae
- ☐ Effective insecticide program

DISEASE: VECTORS

(continued)

☐ NO *(DOES NOT COMPLY)*

Rats and Flies

- ☐ Landfill not practicing daily cover or adequate other techniques
- ☐ Landspreading putrescible wastes without incorporation into the soil or adequate other techniques

Mosquitoes

- ☐ Landfill or landspreading without adequate controls
- ☐ Surface impoundment without adequate controls

CHAPTER 6(b)

DISEASE:
SEWAGE SLUDGE AND SEPTIC TANK PUMPINGS

1.0 Criterion and Definitions

(b) ***Sewage sludge and septic tank pumpings (Interim Final).*** A facility or practice involving disposal of sewage sludge or septic tank pumpings shall not exist or occur unless in compliance with paragraphs (b) (1), (2) or (3) of this section.

(1) Sewage sludge that is applied to the land surface or is incorporated into the soil is treated by a Process to Significantly Reduce Pathogens prior to application or incorporation. Public access to the facility is controlled for at least 12 months, and grazing by animals whose products are consumed by humans is prevented for at least one month. Processes to Significantly Reduce Pathogens are listed in Appendix II, Section A. (These provisions do not apply to sewage sludge disposed of by a trenching or burial operation.)

(2) Septic tank pumpings that are applied to the land surface or incorporated into the soil are treated by a Process to Significantly Reduce Pathogens (as listed in Appendix II, Section A), prior to application or incorporation, unless public access to the facility is controlled for at least 12 months and unless grazing by animals whose products are consumed by humans is prevented for at least one month. (These provisions do not apply to septic tank pumpings disposed of by a trenching or burial operation.)

(3) Sewage sludge or septic tank pumpings that are applied to the land surface or are incorporated into the soil are treated by a Process to Further Reduce Pathogens, prior to application or incorporation, if crops for direct human consumption are grown within 18 months subsequent to application or incorporation. Such treatment is not required if there is no contact between the solid waste and the edible portion of the crop; however, in this case the solid waste is treated by a Process to Significantly Reduce Pathogens, prior to application; public access to the facility is controlled for at least 12 months; and grazing by animals whose products are consumed by humans is prevented for at least one month. If crops for direct human consumption are not grown within 18 months of application or incorporation, the requirements of paragraphs (b) (1) and (2) of this section apply. Processes to Further Reduce Pathogens are listed in Appendix II, Section B.

(c) As used in this section:

(1) "Crops for direct human consumption" means crops that are consumed by humans without processing to minimize pathogens prior to distribution to the consumer.

(2) "Disease vector" means rodents, flies, and mosquitoes capable of transmitting disease to humans.

(3) "Incorporated into the soil" means the injection of solid waste beneath the surface of the soil or the mixing of solid waste with the surface soil.

(4) "Periodic application of cover material" means the application and compaction of soil or other suitable material over disposed solid waste at the end of each operating day or at such frequencies and in such a manner as to reduce the risk of fire and to impede vectors' access to the waste.

(5) "Trenching or burial operation" means the placement of sewage sludge or septic tank pumpings in a trench or other natural or man-made depression and the covering with soil or other suitable material at the end of each operating day such that the wastes do not migrate to the surface.

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APPENDIX II

A. Processes to Significantly Reduce Pathogens

Aerobic digestion: The process is conducted by agitating sludge with air or oxygen to maintain aerobic conditions at residence times ranging from 60 days at 15° C to 40 days at 20° C, with a volatile solids reduction of at least 38 percent.

Air Drying: Liquid sludge is allowed to drain and/or dry on under-drained sand beds, or paved or unpaved basins in which the sludge is at a depth of nine inches. A minimum of three months is needed, two months of which temperatures average on a daily basis above 0° C.

Anaerobic digestion: The process is conducted in the absence of air at residence times ranging from 60 days at 20° C to 15 days at 35° to 55° C, with a volatile solids reduction of at least 38 percent.

Composting: Using the within-vessel, static aerated pile or windrow composting methods, the solid waste is maintained at minimum operating conditions of 40° C for 5 days. For four hours during this period the temperature exceeds 55° C.

Lime Stabilization: Sufficient lime is added to produce a pH of 12 after 2 hours of contact.

Other methods: Other methods or operating conditions may be acceptable if pathogens and vector attraction of the waste (volatile solids) are reduced to an extent equivalent to the reduction achieved by any of the above methods.

B. Processes to Further Reduce Pathogens

Composting: Using the within-vessel composting method, the solid waste is maintained at operating conditions of 55° C or greater for three days. Using the static aerated pile composting method, the solid waste is maintained at operating conditions of 55° C or greater for three days. Using the windrow composting method, the solid waste attains a temperature of 55° C or greater for at least 15 days during the composting period. Also, during the high temperature period, there will be a minimum of five turnings of the windrow.

Heat drying: Dewatered sludge cake is dried by direct or indirect contact with hot gases, and moisture content is reduced to 10 percent or lower. Sludge particles reach temperatures well in excess of 80° C, or the wet bulb temperature of the gas stream in contact with the sludge at the point where it leaves the dryer is in excess of 80° C.

Heat treatment: Liquid sludge is heated to temperatures of 180° C for 30 minutes.

Thermophilic Aerobic Digestion: Liquid sludge is agitated with air or oxygen to maintain aerobic conditions at residence times of 10 days at 55–60° C, with a volatile solids reduction of at least 38 percent.

Other methods: Other methods or operating conditions may be acceptable if pathogens and vector attraction of the waste (volatile solids) are reduced to an extent equivalent to the reduction achieved by any of the above methods.

Any of the processes listed below, if added to the processes described in Section A above, further reduce pathogens. Because the processes listed below, on their own, do not reduce the attraction of disease vectors, they are only add-on in nature.

Beta ray irradiation: Sludge is irradiated with beta rays from an accelerator at dosages of at least 1.0 megarad at room temperature (ca. 20° C).

Gamma ray irradiation: Sludge is irradiated with gamma rays from certain isotopes, such as ^{60}Cobalt and ^{137}Cesium, at dosages of at least 1.0 megarad at room temperature (ca. 20° C).

Pasteurization: Sludge is maintained for at least 30 minutes at a minimum temperature of 70° C.

Other methods: Other methods or operating conditions may be acceptable if pathogens are reduced to an extent equivalent to the reduction achieved by any of the above add-on methods.

2.0 Inventory Procedure

This Criterion applies to all landspreading facilities where sewage sludge or septic tank pumpings are applied to the surface of the land or incorporated into the soil. The Criterion addresses the potential hazard of vectors and pathogen transmission by controlling public access, agricultural practices, and treatment procedures.

For the purpose of the Inventory, it will be necessary to both evaluate conditions at the land application facility and to evaluate the mechanisms by which the sludge or septage is treated prior to land application. This process will likely involve interviews with the sewage treatment plant owner/operator, waste hauler, landspreading facility owner/operator, and government agencies responsible for regulation and/or inspection of any component of the operation. Figure 6(b)-1 presents the decision flow chart.

3.0 Resolution of Decision Flow Chart Questions

3.1 Are sewage sludge or septic tank pumpings applied to the surface of the land or incorporated into the soil?

(a) To determine the location of disposal sites for septic tank pumpings and sewage sludge, contact the appropriate government regulatory agency such as the State or local health department and the water pollution control agency. Should these agencies not have the appropriate information, contact the individual scavenger companies and sewage treatment plants for information on their disposal method and site.

(b) This Criterion is concerned with all landspreading facilities, including both food chain and non-food chain lands. Trenching or burial operations are not subject to evaluation against these provisions of the Criterion.

3.2 Are crops planted for human consumption within 18 months after application of waste?

(a) The determination that crops grown for human consumption are not planted can be made if the crop grown is not ordinarily

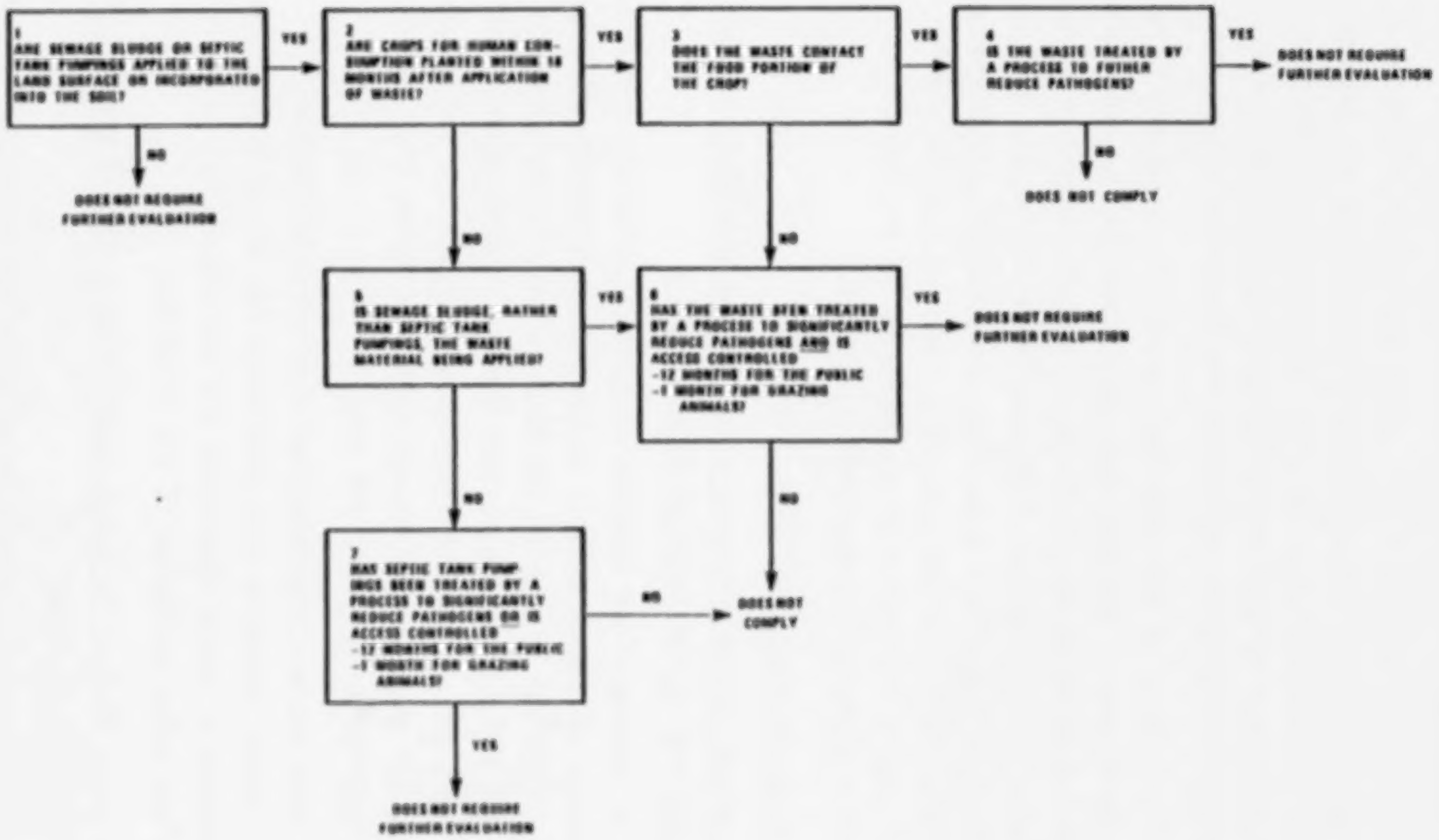
1
ARE SEWAGE SLUDGE OR SEPTIC TANK PUMPINGS APPLIED TO THE LAND SURFACE OR INCORPORATED INTO THE SOIL?
YES
NO
DOES NOT REQUIRE FURTHER EVALUATION
2
ARE CROPS FOR HUMAN CONSUMPTION PLANTED WITHIN 18 MONTHS AFTER APPLICATION OF WASTE?
YES
NO
3
DOES THE WASTE CONTACT THE FOOD PORTION OF THE CROP?
YES
NO
4
IS THE WASTE TREATED BY A PROCESS TO FUTHER REDUCE PATHOGENS?
YES
DOES NOT REQUIRE FURTHER EVALUATION
NO
DOES NOT COMPLY
5
IS SEWAGE SLUDGE, RATHER THAN SEPTIC TANK PUMPINGS, THE WASTE MATERIAL BEING APPLIED?
YES
NO
6
HAS THE WASTE BEEN TREATED BY A PROCESS TO SIGNIFICANTLY REDUCE PATHOGENS AND IS ACCESS CONTROLLED
-12 MONTHS FOR THE PUBLIC
-1 MONTH FOR GRAZING ANIMALS?
YES
DOES NOT REQUIRE FURTHER EVALUATION
NO
DOES NOT COMPLY
7
HAS SEPTIC TANK PUMPINGS BEEN TREATED BY A PROCESS TO SIGNIFICANTLY REDUCE PATHOGENS OR IS ACCESS CONTROLLED
-12 MONTHS FOR THE PUBLIC
-1 MONTH FOR GRAZING ANIMALS?
NO
YES
DOES NOT REQUIRE FURTHER EVALUATION

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FIGURE [illegible] FLOW CHART-DISEASE SEWAGE SLUDGE AND SEPTIC TANK PUMPINGS consumed by man or if the operating plan specifically precludes the crop from this use. If they are not for human consumption, proceed to 3.5.

(b) If the crops planted at the time of the Inventory are for human consumption, then it must be determined:

- when the crop was planted
- the date of the last waste application

The treatment plant operator is one source of information on sludge application dates, and the facility farmer may have a record of when the crop was planted.

3.3 Does the waste contact the food portion of the crop?

Contact with the food portion can be either by direct application of the waste material to the growing crop, by rainfall splash subsequent to application, or by contact during harvesting. Therefore, items of concern are the timing and method of application and the type of crop grown. Crops which bear the food portion close to the ground (as is the case with many vegetables) should be considered to have contact between the food portion and the waste. Taller growing crops (such as many grains and citrus fruits) can be considered not to have contact with the waste so long as it is applied in a manner or at a time that direct contact with the food portion does not occur. Questions concerning the food portion of the crop may be referred to:

- the facility operator
- the facility farmer or other local farmers
- buyers such as grain dealers and co-ops
- Agricultural Extension Service
- State Department of Agriculture
- State University Agriculture Department

Depending on whether the waste contacts the food portion, the processes used to treat the waste prior to application must be examined as described in either 3.4 or 3.6 below (see flow chart).

3.4 Is the waste treated by a Process to Further Reduce Pathogens?

Acceptable processes for the further reduction of pathogens are listed in Appendix II, Section B, of the Criteria. Verification that an accepted process for additional pathogen reduction is used must be obtained. Specific information should be available from the records of the sewage treatment plant or septic tank hauler where the material originated. Major sources of information are the State and local health and water pollution control agencies. Verification may be complex; and ideally, sanitary engineers familiar with the treatment processes should be consulted. Quality control and monitoring data should be examined. If this verification cannot be made, the State should assume that an appropriate process to further reduce pathogens has not been utilized.

If the waste is successfully treated by a Process to Further Reduce Pathogens, *the facility does not require further evaluation*. Otherwise, *the facility does not comply*.

3.5 Is sewage sludge, rather than septic tank pumpings, the waste material being applied?

The Criterion provides slightly different controls for sewage sludge than for septic tank pumpings. Thus, it is necessary to determine which of these wastes is being applied at the facility. If the waste includes sewage sludge, proceed to 3.6. If sewage sludge is not applied but septic tank pumpings are, proceed to 3.7.

3.6 Has the waste been treated by a Process to Significantly Reduce Pathogens and is access controlled - 12 months for the public, and 1 month for grazing animals whose products are consumed by man?

(a) Acceptable processes for significantly reducing pathogens are listed in Appendix II, Section A, of the Criteria. Verification that an accepted process for pathogen reduction is used must be obtained. Specific information should be available from the records of the sewage treatment plant or septic tank hauler where the material originated. Major sources of information are the State and local health and water pollution control agencies. If this verification cannot be made, the State should assume that an appropriate pathogen reduction process has not been utilized.

(b) Specific access controls are addressed in the access section of this manual. Where waste is applied to public access areas positive control measures should be taken; however, in the case of private farmland, this should not be necessray unless the area is subject to frequent trespass by the general public. The farmer, his family, and employees are considered "authorized persons" as covered in Chapter 2(d).

If the sludge has not been successfully treated by a Process to Significantly Reduce Pathogens, or if access is not appropriately controlled, *the facility does not comply.* Otherwise, *the facility does not require further evaluation.*

3.7 Have the septic tank pumpings been treated by a Process to Significantly Reduce Pathogens or is access controlled - 12 months for the public and 1 month for grazing animals whose products are consumed by man?

The requirements for septic tank pumpings are identical to those for sewage sludge as addressed by Question 3.6, except that either access must be controlled or a pathogen reduction process must be used, rather than both.

If both (1) the septic tank pumpings have not been treated by a Process to Significantly Reduce Pathogens and (2) access is not appropriately controlled, *the facility does not comply.* Otherwise, *the facility does not require further evaluation.*

CHAPTER 6(b)

SEWAGE SLUDGE AND SEPTIC TANK PUMPINGS

Criterion Compliance Decision

☐ *Does Not Require Further Evaluation*

☐ *Does Not Comply*

1. Are sewage sludge or septic tank pumpings applied to the surface of the land or incorporated into the soil?

☐ YES (continue to 2)

☐ NO (*DOES NOT REQUIRE FURTHER EVALUATION*)

- ☐ Facility is a trenching or burial operation

2. Are crops planted for human consumption within 18 months after application of waste?

☐ YES (continue to 3)

- ☐ Crops grown at time of inventory are for human consumption
- ☐ Information from operating plan
- ☐ Past usage or crops in the vicinity
- ☐ Information from facility owner/operator

☐ NO (continue to 5)

3. Does the waste contact the food portion of the crop?

☐ YES (continue to 4)

- ☐ Direct application or rainfall splash
- ☐ Crops with food portion close to the ground
- ☐ Taller crops that receive application early in growing stage
- ☐ Contact during harvest

☐ NO (continue to 6)

4. Is the waste treated by a Process to Further Reduce Pathogens?

☐ YES (*DOES NOT REQUIRE FURTHER EVALUATION*)

- ☐ Verification of acceptable process from appropriate source
  Source used ______________________________

☐ NO (*DOES NOT COMPLY* - continue to 5)

- ☐ Treatment process is not utilized
- ☐ Verification cannot be made

CHAPTER 6(b)

SEWAGE SLUDGE AND SEPTIC TANK PUMPINGS

(continued)

5. Is sewage sludge, rather than septic tank pumpings, the waste material being applied?

☐ YES (continue to 6)

☐ NO (continue to 7)

6. Has the sludge been treated by a Process to Significantly Reduce Pathogens, and is access controlled - 12 months for the public, and 1 month for grazing animals whose products are consumed by man? (Evaluation under this section is unnecessary if the answer to 4 is yes.)

☐ YES (Both reduction process and access control must be checked) (*DOES NOT REQUIRE FURTHER EVALUATION*)

- ☐ Verification of acceptable process from appropriate source
  Source used ______________________________
- ☐ Appropriate access controls are used in public access areas
- ☐ Facility is on private farmland not subject to frequent trespass

☐ NO (*DOES NOT COMPLY*)

- ☐ Treatment process is not utilized
- ☐ Verification cannot be made
- ☐ No access controls are used
- ☐ Facility is on private farmland subject to frequent trespass, and access is not controlled

7. Has the waste been treated by a Process to Significantly Reduce Pathogens, or is access controlled - 12 months for the public and 1 month for grazing animals whose products are consumed by man?

☐ YES (Either reduction process or access control must be checked) (*DOES NOT REQUIRE FURTHER EVALUATION*)

- ☐ Verification of acceptable process from appropriate source
  Source used ______________________________
- ☐ Access controlled

☐ NO (*DOES NOT COMPLY*)

CHAPTER 7

APPLICATION TO LAND USED FOR THE PRODUCTION OF FOOD-CHAIN CROPS

1.0 Criterion and Definitions

§ 257.3–5 Application to land used for the production of food-chain crops (interim final).

(a) *Cadmium.* A facility or practice concerning application of solid waste to within one meter (three feet) of the surface of land used for the production of food-chain crops shall not exist or occur, unless in compliance with all requirements of paragraph (a)(1) (i) through (iii) of this section or all requirements of paragraph (a)(2) (i) through (iv) of this section.

(1)(i) The pH of the solid waste and soil mixture is 6.5 or greater at the time of each solid waste application, except for solid waste containing cadmium at concentrations of 2 mg/kg (dry weight) or less.

(ii) The annual application of cadmium from solid waste does not exceed 0.5 kilograms per hectare (kg/ha) on land used for production of tobacco, leafy vegetables or root crops grown for human consumption. For other food-chain crops, the annual cadmium application rate does not exceed:

Time period	Annual Cd application rate (kg/ha)
Present to June 30, 1984	2.0
July 1, 1984 to Dec. 31, 1986	1.25
Beginning Jan. 1, 1987	0.5

(iii) The cumulative application of cadmium from solid waste does not exceed the levels in either paragraph (a)(1)(iii)(A) of this section or paragraph (a)(1)(iii)(B) of this section.

(A)

Soil cation exchange capacity (meq/100g)	Maximum cumulative application (kg/ha)	
	Background soil pH <6.5	Background soil pH ≥6.5
<5	5	5
5–15	5	10
>15	5	20

(B) For soils with a background pH of less than 6.5, the cumulative cadmium application rate does not exceed the levels below: *Provided,* That the pH of the solid waste and soil mixture is adjusted to and maintained at 6.5 or greater whenever food-chain crops are grown.

Soil cation exchange capacity (meq/100g)	Maximum cumulative application (kg/ha)
<5	5
5–15	10
>15	20

(2)(i) The only food-chain crop produced is animal feed.

(ii) The pH of the solid waste and soil mixture is 6.5 or greater at the time of solid waste application or at the time the crop is planted, whichever occurs later, and this pH level is maintained whenever food-chain crops are grown.

(iii) There is a facility operating plan which demonstrates how the animal feed will be distributed to preclude ingestion by humans. The facility operating plan describes the measures to be taken to safeguard against possible health hazards from cadmium entering the food chain, which may result from alternative land uses.

(iv) Future property owners are notified by a stipulation in the land record or property deed which states that the property has received solid waste at high cadmium application rates and that food-chain crops should not be grown, due to a possible health hazard.

(b) *Polychlorinated Biphenyls (PCBs).* Solid waste containing concentrations of PCBs equal to or greater than 10 mg/kg (dry weight) is incorporated into the soil when applied to land used for producing animal feed, including pasture crops for animals raised for milk. Incorporation of the solid waste into the soil is not required if it is assured that the PCB content is less than 0.2 mg/kg (actual weight) in animal feed or less than 1.5 mg/kg (fat basis) in milk.

(c) As used in this section:

(1) "Animal feed" means any crop grown for consumption by animals, such as pasture crops, forage, and grain.

(2) "Background soil pH" means the pH of the soil prior to the addition of substances that alter the hydrogen ion concentration.

(3) "Cation exchange capacity" means the sum of exchangeable cations a soil can absorb expressed in milli-equivalents per 100 grams of soil as determined by sampling the soil to the depth of cultivation or solid waste placement, whichever is greater, and analyzing by the summation method for distinctly acid soils or the sodium acetate method for neutral, calcareous or saline soils ("Methods of Soil Analysis, Agronomy Monograph No. 9." C. A. Black, ed., American Society of Agronomy, Madison, Wisconsin, pp 891–901, 1965).

(4) "Food-chain crops" means tobacco, crops grown for human consumption, and animal feed for animals whose products are consumed by humans.

(5) "Incorporated into the soil" means the injection of solid waste beneath the surface of the soil or the mixing of solid waste with the surface soil.

(6) "Pasture crops" means crops such as legumes, grasses, grain stubble and stover which are consumed by animals while grazing.

(7) "pH" means the logarithm of the reciprocal of hydrogen ion concentration.

(8) "Root crops" means plants whose edible parts are grown below the surface of the soil.

(9) "Soil pH" is the value obtained by sampling the soil to the depth of cultivation or solid waste placement, whichever is greater, and analyzing by the electrometric method. ("Methods of Soil Analysis, Agronomy Monograph No. 9," C.A. Black, ed., American Society of Agronomy, Madison, Wisconsin, pp. 914–926, 1965.)

2.0 Inventory Procedure

This Criterion is applicable only to facilities where solid waste is applied to land which is used for the production of food-chain crops. Such facilities must comply with this Criterion as well as with the rest of the Criteria.

The major components of the Criterion establish facility operation standards for two areas of concern. These are:

- Cadmium. There are two separate control approaches. In the first [40 CFR 257.3-5(a)(1)], the annual and cumulative cadmium loadings, and the solid waste-soil pH are controlled. In the second [40 CFR 257.3-5(a)(2)], a crop marketing plan (animal feed only), facility land records and pH controls mitigate the effects of cadmium in the environment. A facility growing only animal feed could be evaluated against either approach.

- Polychlorinated Biphenyls (PCBs). When PCBs are present in concentrations greater than or equal to 10 mg/kg, land application methods or crop/milk monitoring must be employed.

The decision flow chart is presented in Figure 7-1.

2.1 Further Definitions

As used in this chapter:

(a) "Applied within one meter of the surface of land" refers to waste being injected, spread on the surface, or plowed into the soil.

(b) "Food-chain crops" are tobacco, crops grown for human consumption, and vegetation used to feed animals whose products (e.g., milk and meat) are consumed by man.

(c) Land is to be considered "for the production of food-chain crops," if either the crop being grown at the time of the evaluation, or intended to be grown in the future, is a food-chain crop. The evaluation should recognize that Criterion 40 CFR 257.3-6(b) (Disease) may independently preclude growth of a food-chain crop during the period of solid waste application. Consequently, future agricultural use should be considered. Specific information on the potential consumers or uses of particular crops and agricultural lands should be available through the following sources:

- the facility operator
- the facility farmer or other local farmers
- buyers such as grain dealers and co-ops
- local Agricultural Extension Service
- State Department of Agriculture
- State University Agriculture Department

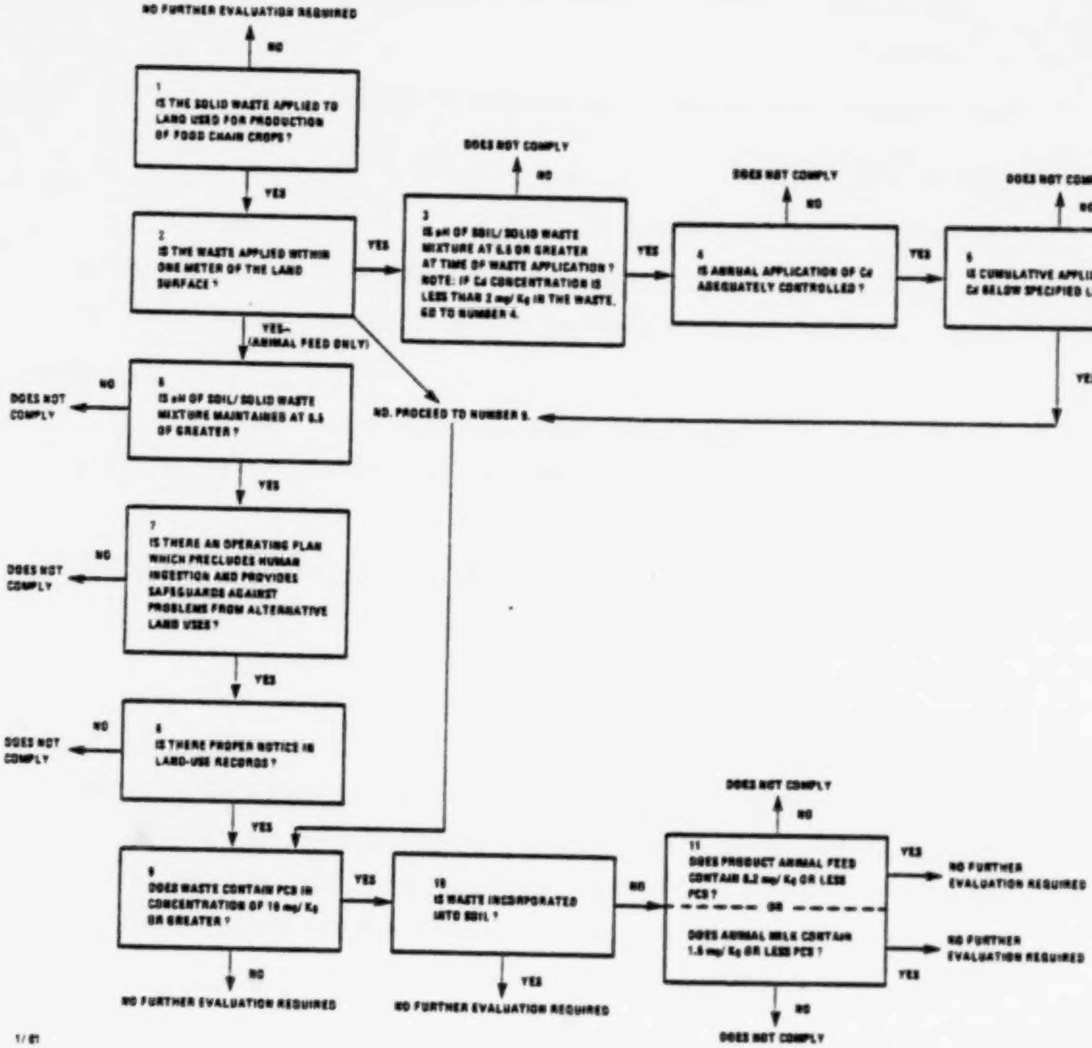
NO FURTHER EVALUATION REQUIRED
NO
1
IS THE SOLID WASTE APPLIED TO LAND USED FOR PRODUCTION OF FOOD CHAIN CROPS ?
YES
2
IS THE WASTE APPLIED WITHIN ONE METER OF THE LAND SURFACE ?
YES
DOES NOT COMPLY
NO
3
IS pH OF SOIL/ SOLID WASTE MIXTURE AT 6.5 OR GREATER AT TIME OF WASTE APPLICATION ? NOTE: IF Cd CONCENTRATION IS LESS THAN 2 mg/ Kg IN THE WASTE, GO TO NUMBER 4.
YES
DOES NOT COMPLY
NO
4
IS ANNUAL APPLICATION OF Cd ADEQUATELY CONTROLLED ?
YES
DOES NOT COMPLY
NO
5
IS CUMULATIVE APPLICATION OF Cd BELOW SPECIFIED LIMITS ?
YES
YES–
(ANIMAL FEED ONLY)
NO, PROCEED TO NUMBER 9.
NO
DOES NOT COMPLY
6
IS pH OF SOIL/ SOLID WASTE MIXTURE MAINTAINED AT 6.5 OF GREATER ?
YES
NO
DOES NOT COMPLY
7
IS THERE AN OPERATING PLAN WHICH PRECLUDES HUMAN INGESTION AND PROVIDES SAFEGUARDS AGAINST PROBLEMS FROM ALTERNATIVE LAND USES ?
YES
NO
DOES NOT COMPLY
8
IS THERE PROPER NOTICE IN LAND-USE RECORDS ?
YES
9
DOES WASTE CONTAIN PCB IN CONCENTRATION OF 10 mg/ Kg OR GREATER ?
NO
NO FURTHER EVALUATION REQUIRED
YES
10
IS WASTE INCORPORATED INTO SOIL ?
YES
NO FURTHER EVALUATION REQUIRED
NO
DOES NOT COMPLY
NO
11
DOES PRODUCT ANIMAL FEED CONTAIN 0.2 mg/ Kg OR LESS PCB ?
OR
DOES ANIMAL MILK CONTAIN 1.5 mg/ Kg OR LESS PCB ?
YES
NO FURTHER EVALUATION REQUIRED
YES
NO FURTHER EVALUATION REQUIRED
NO
DOES NOT COMPLY

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FIGURE 7-1. FLOW CHART – APPLICATION TO LAND USED FOR THE PRODUCTION OF FOOD-CHAIN CROPS

3.0 Resolution of Decision Flow Chart Questions

3.1 Is solid waste applied to land which is used for the production of food-chain crops?

In most cases, the type of solid waste applied to agricultural land is sewage sludge. In some locations, other types of solid waste, such as food processing wastes and refined municipal refuse compost are landspread. The procedures outlined in this chapter focus on landspreading of sewage sludge used to amend agricultural soils, although the procedures also allow evaluations of other types of activities.

If solid waste is not applied to land used for food-chain crop production, the facility can be eliminated from further evaluation against the Criterion. Otherwise, proceed to Section 3.1.1 of this Chapter.

3.1.1 Is solid waste applied within one meter of the land surface?

If the waste is applied within one meter of the land surface, the facility must be evaluated against the cadmium portion of the Criterion, using the procedures of Section 3.2. If not, proceed directly to consideration of PCBs as described in Section 3.3.

3.2 Cadmium

Cadmium application is evaluated differently depending on whether the crop is for human ingestion or for animal feed only. Note that crops for human ingestion include those for production of animal milk or meat for human ingestion. After determining which type of crop is grown, cadmium application should be evaluated as described in Section 3.2.1 or 3.2.2 below.

3.2.1 Evaluation of cadmium application where crop is other than only animal feed [40 CFR 257.3-5(a)(1)]

(a) Is the cadmium concentration in the waste less than 2 mg/kg (dry weight basis)?

Obtain a sample of the waste as suggested in Appendix 7-1 (Sampling and Analysis). If the waste contains less than 2 mg/kg (dry weight basis) of cadmium, proceed to 3.2.1(d). Otherwise, proceed to 3.2.1 (b).

(b) Is the pH of the soil/waste mixture 6.5 or greater at the time of application?

Obtain a sample of the soil/waste mixture in the area of the land that has received waste most recently (see Appendix 7-1). If the pH is 6.5 or greater, or if it is only slightly less and pH control is being practiced to obtain 6.5 or greater, proceed to 3.2.1 (c). Otherwise, *the facility does not comply.* Proceed to 3.3. The regular application of agricultural lime is a normal method of raising pH.

(c) Is waste applied to land used for the production of tobacco, leafy vegetables, or root crops grown for human consumption?

(i) "Root crops" are plants whose edible parts are grown below the surface of the soil.

(ii) Similarly, "leafy vegetables" are those whose leaves are ordinarily ingested by humans, such as lettuce and cabbage.

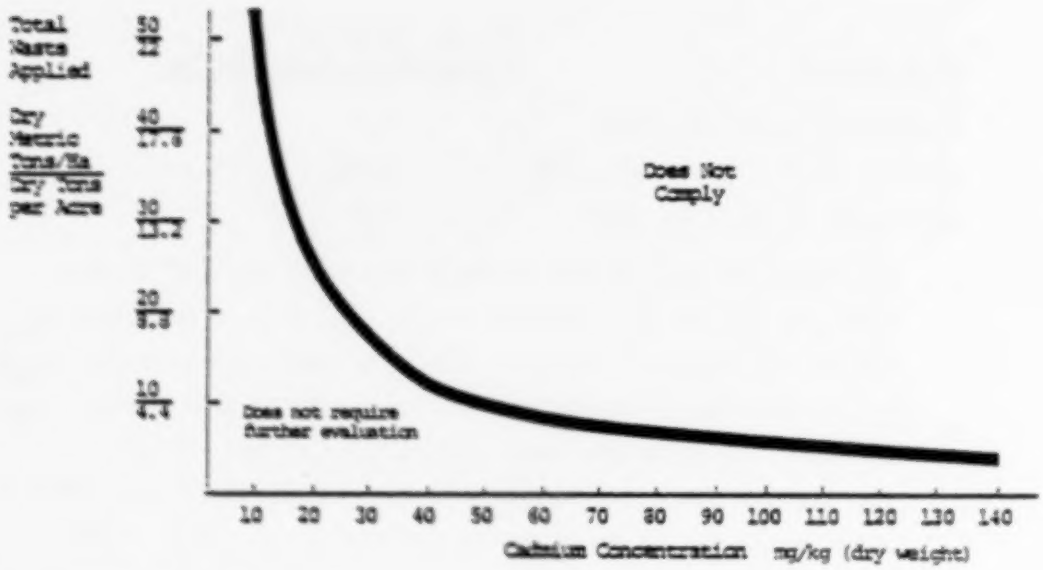
If there is any question as to the use of any portion of the crop, information could be available through the sources presented in Section 3.1 (c).

If so, proceed to 3.2.1 (d). Otherwise, proceed to 3.2.1 (e).

(d) Is the cadmium loading rate less than 0.5 kg per hectare per year?

Estimate the total amount of waste which has been applied to the land over the past twelve months. Using the cadmium concentration analysis obtained in 3.2.1 (a), determine the annual cadmium application from Figure 7-2. If the annual

FIGURE 7-2 ANNUAL CADMIUM APPLICATION DECISION GRAPH FOR TOBACCO, LEAFY VEGETABLES, AND ROOT CROPS (0.5 Kg/ha (DRY WEIGHT)



Note: If the point falls clearly above the line, the facility does not comply. If the point falls clearly below the line, the facility does not require further evaluation. However, if the point falls on or near the line, it will be necessary to judge the reliability and accuracy of the information used in making the determination. If values are not on the chart, then use the following equation to calculate the allowable loading rate.

$$\frac{500}{\text{Cd concentration (mg/kg) (dry weight)}} = \text{allowable loading rate MT/HA}$$

cadmium application exceeds 0.5 kg/ha, *the facility does not comply*. Proceed to 3.3. Otherwise, proceed to (e).

(e) Where waste is being applied on land used for production of food-chain crops other than those identified in 3.2.1 (c), the annual cadmium application must not exceed:

Time Period	Annual Cadmium Application Rate (kg/ha)
Present to June 30, 1984	2.0
July 1, 1984 to Dec. 31, 1986	1.25
Beginning January 1, 1987	0.5

(i) Estimate the amount of waste which is applied to the facility in the past twelve months. It may be possible to obtain all this information from the operating records, or it may be necessary to analyze the waste for solids content and cadmium concentration (see Appendix 7-1), and obtain information from the operator on the total amount of material which would be expected to be applied in one year. Use the cadmium concentration obtained in 3.2.1 (a).

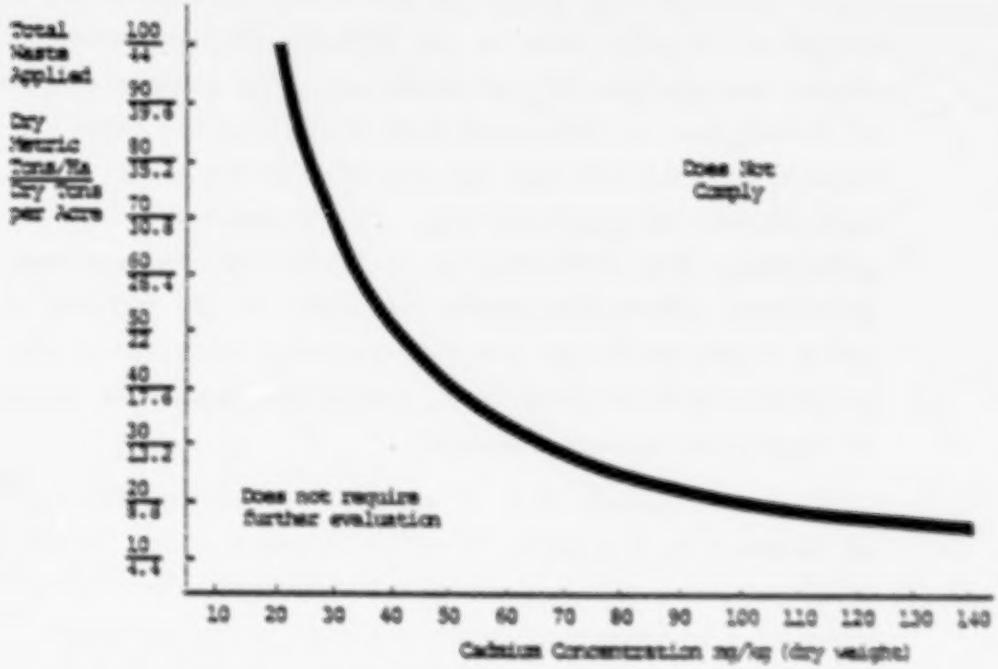
(ii) With this information, determine whether the annual cadmium application exceeds the above values by using Figure 7-3 (example shown for 2.0 kg/ha). If the appropriate rate is exceeded, *the facility does not comply*. Proceed to 3.3. Otherwise, proceed to (f).

(f) The cumulative application of cadmium from solid waste cannot exceed the levels established in either (i) or (ii) below.

(i)

Soil cation exchange capacity (meq/100 g)	Maximum cumulative application (kg/ha)	
	Background soil pH <6.5	Background soil pH >6.5
<5	5	5
5-15	5	10
>15	5	20

FIGURE 7-3 ANNUAL CADMIUM APPLICATION DECISION GRAPH (2.0 Kg/ha) (EFFECTIVE UNTIL JUNE 30, 1984)



Note: If values are not on the chart, then use the following equation to calculate the allowable loading rate

$$\frac{2{,}000}{\text{Cd concentration (mg/kg) (dry weight)}} = \text{allowable loading rate MT/HA}$$

If the point falls clearly above the line, the facility does not comply. If the point falls clearly below the line, the facility does not require further evaluation. If, however, the point falls on or near the line, it will be necessary to judge the reliability and accuracy of the information used in making the determination.

This matrix shows the maximum cumulative application of cadmium allowed for the described background soil pH and cation exchange capacity. The background soil pH refers to the pH of the soil prior to the addition of a substance that alters the hydrogen ion concentration. The primary sources of information on background soil pH will be the Soil Conservation Service maps and reports and the local Agricultural Extension Service. In the absence of information from these sources, a laboratory analysis must be performed. Obtain the sample from areas in the vicinity of the facility which have not been recently subjected to pH adjustment such as fence rows, fields that have been fallow for some time or wooded areas.

Due to a general lack of accurate records and the rigor of determining compliance by other means, a screen has been developed. For the purpose of the Inventory, the maximum cumulative cadmium application has been converted from kilograms of cadmium per hectare of soil area to a soil cadmium concentration in milligrams per kilogram. The levels are listed in the table below:

Cation Exchange Capacity	Cumulative Loading Rate, kg/ha	Soil Cadmium Concentration, mg/kg
<5	5	2.27
5-15	10	4.5
>15	20	9.08

The conversion was made using a typical plow depth, soil density, and background cadmium concentration.

With the upper limits of the matrix stated in terms of soil cadmium concentrations, a comparison can be made with the current cadmium concentration to identify facilities that need additional soil monitoring and analysis to determine non-compliance.

(1) The soil cation exchange capacity (CEC) information may be available from the Soil Conservation Service or the local Agricultural Extension Service. In the absence of information from these sources, a laboratory analysis must be performed. Obtain the sample from areas in the facility which have been receiving solid waste (see Appendix 7-1).

(2) To determine the soil cadmium concentration, obtain a sample for analysis in the area to which waste is to be applied (see Appendix 7-1).

(3) If the analysis shows the cadmium concentration to be less than the soil concentrations given above, *no further evaluation is needed for this subsection*. Proceed to 3.3.

(4) If the analysis shows the cadmium concentration to be in excess of the soil concentrations given above, further analysis will be necessary to prove non-compliance.

(5) Determine the cumulative cadmium loading as described in Appendix 7-1. If the application is determined to exceed the rates listed in the Criterion, *the facility does not comply*. Proceed to 3.3.

(ii) For soils with a background pH of less than 6.5, the cumulative cadmium application rate does not exceed the levels below, *Provided*, that the pH of the solid waste and soil mixture is adjusted to and maintained at 6.5 or greater whenever food-chain crops are grown.

Soil cation exchange capacity (meq/100 g)	Maximum cumulative application (kg/ha)
<5	5
5-15	10
>15	20

When the soil background pH is less than 6.5, the site might be managed to maintain a higher pH whenever food-chain crops are grown. This method is intended only for facilities that are closely managed by the solid waste generator. The generator must clearly demonstrate long-term safeguards that will assure the soil pH will be maintained at 6.5 or higher whenever food-chain crops are grown. Such safeguards could include a facility management plan which would consist of routine soil pH monitoring and liming the soil when necessary, or a statement in writing from the facility owner that this requirement will be met. The method of calculating the cumulative application of cadmium is outlined in (i) above. If the appropriate rate in the above table is exceeded, *the facility does not comply*. Proceed to 3.3.

3.2.2 Evaluation of cadmium application where crop is only animal feed [40 CFR 257.3-5(a)(2)].

This part is applicable only if the food-chain crops are grown for animal feed. Otherwise, the cadmium application aspects of the facility's operation must be evaluated only against 40 CFR 257.3-5(a)(1) (see chapter Section 3.2.1). If the food-chain crops are grown for only animal feed, proceed to (a).

(a) Is the solid waste and soil mixture at pH 6.5 or greater at the time of solid waste application or at the time the crop is planted, whichever occurs later?

The techniques for determining the solid waste/soil pH are presented in Appendix 7-1. If this condition is not satisfied, regardless of the cadmium concentration of the solid waste, *the facility does not comply*. Proceed to 3.3. Otherwise, proceed to (b).

(b) Is the pH of the solid waste/soil mixture maintained at 6.5 or greater whenever food-chain crops are being grown?

If the initial solid waste/soil mixture is significantly greater than 6.5, it is likely that it will not drop below 6.5 during the growing season. This is particularly true when the background soil pH [see 3.2.1 (f)(i)] is alkaline. If the soils are naturally acidic, and if significant applications of agricultural lime do not occur, it is likely that the solid waste/soil pH may fall below 6.5 during the growing season. Periodic sampling should be conducted to make determinations. If the pH is not so maintained, *the facility does not comply*. Proceed to 3.3. Otherwise, proceed to (c).

(c) Is there an operating plan which demonstrates how the crop is to be distributed to preclude ingestion by humans and provides safeguards to prevent possible health hazards resulting from alternative future uses of the land?

To determine if the facility is meeting this requirement, read the operating plan and discuss with the operator or facility farmer the chain of possession of the crop after harvest. To comply, the crop must be distributed so that there is no chance of ingestion by humans; for example, it could be sold directly to a farm where it would be fed to horses. The operating plan must also describe the measures being taken to safeguard against possible health hazards from cadmium entering the food chain, which may result from alternative future land uses. Some future land uses, such as the establishment of vegetable farms or home vegetable gardens, could result in significant dietary increases of cadmium. Such provisions in the facility operating plan could include: dedication of the facility as a public park, placement of fresh top soil over the site, or consist of chisel plow removal of the contaminated soil. If this requirement is not satisfied, *the facility does not comply*. Proceed to 3.3. Otherwise, proceed to (d).

(d) Does a notice appear in the land records notifying any future owners that the property has received solid waste at high cadmium application rates and that food-chain crops should not be grown, due to a possible health hazard?

Obtain a copy of the land records from the owner or the State or local government land records department. If the notice does not appear, *the facility does not comply with the Criterion*. Proceed to 3.3.

3.3 The next major step is to evaluate the application of polychlorinated biphenyls (PCBs) at the facility [40 CFR 257.3-5(b)].

(a) Does the waste contain concentrations of PCBs equal to or greater than 10 mg/kg?

(i) Obtain a sample, following the suggestions in the Sampling and Analysis section of Appendix 7-1.

(ii) If the lab analysis shows the PCB concentration to be less than 10 mg/kg, *no further evaluation is necessary*. If it shows it to be equal to or greater than 10 mg/kg, see (a)(iii) below and proceed to (b).

(iii) If the analysis shows PCBs to be greater than 50 ppm, other USEPA regulations apply. See 40 CFR Part 761, Polychlorinated Biphenyls.

(b) Is the waste incorporated into the soil of land used for producing animal feed, including pasture crops for animals raised for milk?

"Incorporate into the soil" means the injection or mixing of the solid waste into the soil. Some methods of incorporation consist of chisel plow injectors, plow furrow cover equipment on tank trucks, surface spreading followed by plowing or discing; and flexible hose attachments on moldboard or disc plows. If the waste is incorporated into the soil, *no further evaluation is necessary*. Otherwise, proceed to (c).

(c) Is the milk or animal feed monitored to assure that the PCBs concentration is less than 1.5 mg/kg (fat basis) in the milk or less than 0.2 mg/kg in the animal feed?

This Criterion applies only if the waste is not incorporated into the soil. If it is not incorporated, the animal feed and milk must be monitored at the time of sale or harvest. If no monitoring is done or if analysis shows that the limits are exceeded, *the facility does not comply*. If monitoring shows the crop to be within the limits, *no further evaluation is necessary*. If limits are exceeded, State or Federal agencies should be consulted for guidance on disposition of the product.

4.0 References

1. U.S. Environmental Protection Agency. Test Methods for Evaluating Solid Waste - Physical/Chemical Methods. Office of Water and Waste Management, SW-846, 1980.

2. Ellis, R., et al. Sampling and Analysis of Soils, Plants, Wastewaters, and Sludge: Suggested Standardization and Methodology. Agricultural Experiment Station, Kansas State University, Research Publication 170, Manhattan, Kansas, 1975.

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APPENDIX 7-1

SAMPLING AND ANALYSIS

SAMPLING AND ANALYSIS

To evaluate several subsections of the Criterion, it will be necessary for the State to collect and analyze samples of the solid waste, the soil, the soil/waste mixture, and occasionally the crop. In order to obtain results which are representative of site conditions, a well-designed sampling procedure is strongly suggested.

This Appendix contains general procedures for sample collection and analysis. Detailed protocols can be obtained from the listed references; these references should be reviewed prior to initiation of facility evaluations for this Criterion. Written procedures for sampling and analysis should be prepared by the State prior to site evaluations. These procedures should be prepared in consultation with professional chemists, soil scientists, and engineers trained in the subject.

The Appendix also contains a method to calculate the cumulative cadmium application to the land. This procedure is useful in completing evaluations for Section 3.2.1 (f) of this chapter.

The methods discussed deal primarily with sewage sludge application to agricultural land. Methodologies to deal with other types of solid waste are more poorly developed; information is included where available.

Solid Waste Sampling

Samples of sludge or other solid wastes should be collected prior to their application to the land. Sludge should be collected at the treatment plant at the point in the treatment process from which it is transferred to the land application site (e.g., the dewatering belts). Because sludge composition may fluctuate daily or seasonally, depending on periods of industrial discharge, sewered population, and other factors, it is important to design a sample collection process which will accurately reflect influent variations and facility operation patterns. It may be useful to review the treatment facility's operating records and manual to determine the normal periods of such fluctuations. The NPDES permitting or discharge license control agency could also be consulted.

A general discussion of sampling theory and sampling devices is presented in Reference 1, Chapters 1 and 3, respectively. More detailed sampling procedures are presented in Reference 2. Collection of municipal refuse samples is discussed in Reference 3. The use of experienced personnel is strongly recommended for all sampling.

Soil Sampling

The procedures for soil sampling are ultimately site specific. However, several general methods and cautions can be presented.

(a) Obtain a site plan. This plan should identify those portions of the facility which have received the application of solid waste, and should also identify pertinent geographic features (roads, buildings, streams, seasonal drainage channels, treeline, property line, etc.).

(b) Obtain a soils map. It is most useful to utilize the soil classification and nomenclature system published by the local U.S. Department of Agriculture Soil Conservation Service District. This agency will generally have a large body of published and open-file information of the district's soil conditions (soils maps, representative chemical and textural analyses, etc.). This map should ideally be drawn on, or overlay the site plan.

The State, county, or state university soil or agricultural service may have similar information.

(c) Obtain published or open-file information for the soil types present at the facility from one of the agencies listed in (b). Information on the typical natural concentrations of cadmium, pH levels, and cation exchange capacities can be used as quality control checks for the specific values determined for background soil conditions.

(d) Design a soil sampling procedure. Each waste-amended soil type present at the facility should be characterized by sampling. Background soil conditions should also be established by sampling. The number of samples needed to define representative conditions can be divided into vertical and lateral components. References 2 and 4 are extremely useful aids. The following discussion is not intended to supplant the information available in these references.

Soil properties vary over depth. For example, cation exchange capacity (CEC) may be typically higher in the organic-rich A horizon than in the lower zones of the soil. Soil pH is also influenced by organic content and normal soil processes. However, the Criterion at 40 CFR 257.3-5 (c)(3) requires that CEC be determined by sampling the soil to the depth of cultivation or to the depth of solid waste placement, whichever is greater. Sampling for soil pH must be performed in a similar manner.

Two approaches to vertical sampling may be appropriate. Where plowing has mixed natural soil profiles, chemical properties may have been averaged over the zone. Results of two or three vertically distributed samples over the zone of waste incorporation can be averaged to describe representative conditions. This is not appropriate for describing solid waste-amended soils where the waste has not been incorporated. In this case, which may be typical of sludge application to hay land, only the upper zone of the soil may be appropriately sampled. Specific technical assistance should be sought from professional soil scientists.

Lateral variations in soil conditions within the same mappable unit can occur. The sampling intensity needed to obtain a given accuracy for some characteristic depends on the magnitude of variation within the soil type. The literature review from (c) may be useful in describing this natural variability. If the variability in CEC or cadmium is significant compared to the cadmium application limits of the Criterion, it may be useful to determine the number of required soil samples by the method described in Appendix 1 of Reference 2.

Atypical portions of a facility, such as minor depressions, old fence lines, and the edge of a field, should not be sampled. Soils used to grow different crops could also be examined separately. Changes in the depth of plowing should be determined; an increase from six to eight inches plowing depth may result in a significant "dilution" of an artificially introduced contaminant.

After representative soil properties have been defined, they can be compared to the levels established in the Criterion. Caution should be used when examining individual sample results; a result may not be at all representative of site conditions. Forming composite samples may avoid such "noise," but may also result in a failure to encounter unusual conditions warranting closer inspection.

Laboratory Analysis

Analytical determinations of solid waste and soil are more complex than routine water analyses, in that extraction or digestion methods are needed to prepare the sample for analysis. Because different waste types may not respond similarly to the same digestion process, trial runs and quality control methods may be needed.

Only competent professional laboratories should participate. The State should be certain that the laboratory has been fully informed of the nature of the samples, the methods used in their collection and transportation to the laboratory, and the desired precision of the analysis. The State should ideally discuss the evaluation program with the laboratory prior to collecting samples.

The laboratory selected should use accepted and approved techniques. The following section presents some useful references and suggested techniques for the major analytical components.

(a) Cadmium:

> While standard methods are available for water and wastewater analyses, there are at present no universally recognized standard digestion procedures for total cadmium determination in sludges. This is not a serious problem for the Inventory, however, because many laboratories employ generally accepted acid digestion methods. Once a complete digestion has been made, the cadmium in the solution can be determined by standard methods.

Reference 2 presents useful information for sludge, soil, and plant digestion methods. Once the solid material has been digested using a "total cadmium" procedure, the resulting solution should be analyzed for cadmium using Reference 5 (methods 213.1 and 213.2). Operating manuals furnished by atomic absorption spectrophotometer manufacturers (such as Perkin-Elmer: Analytical Methods for Atomic Absorption Spectrophotometry, 1976, Norwalk, Connecticut) may contain useful digestion procedures.

(b) Soil pH, Cation Exchange Capacity, Bulk Density:

The Criterion, at 40 CFR 257.3-5(c)(9), indicates that soil pH must be determined by the method presented in Reference 4, pages 914-926. Similarly, at 40 CFR 257.3-5(c)(3), procedures for cation exchange capacity are indicated as those presented in Reference 4, pages 891-901. For distinctly acid soils, CEC is determined by the summation technique (exchangeable Ca + Mg + K + Na + exchange acidity). For neutral, calcareous, or saline soils, the sodium acetate method must be used.

Reference 4 also presents recognized methods for determination of soil bulk density.

(c) Polychlorinated Biphenyls (PCBs):

Extraction and determination procedures for PCBs are presented in Reference 6. The State may also wish to consult publications of the U.S. Food and Drug Administration (PCB Analysis of Milk and Animal Feed) and the Association of Official Analytical Chemists.

Cumulative Cadmium Application

To determine the cumulative cadmium application, obtain representative determinations of the background soil cadmium concentration, the soil cadmium concentration where solid wastes have been applied, the normal depth of tillage, and the soil density.

(a) The background soil cadmium concentration refers to the cadmium concentration prior to the addition of solid waste. Obtain a representative soil determination from areas in the vicinity of the facility with the same soil type which have not had solid waste applied to them. Such areas might include fence rows, wooded areas (avoid sampling duff layer), or fields which have not received solid waste (see Soil Sampling).

(b) To determine the soil cadmium concentration (mg/kg), obtain a representative determination from the zone of cultivation in the area to which waste is to be applied (see Soil Sampling).

(c) To determine the normal depth of tillage, ask the operator what cultivation practices are used in the area to which waste is applied. To convert inches to the required meters, multiply by 0.025 (inches x 0.025 = meters).

(d) The soil density (kg/ha) may be available from the Soil Conservation Service or the local Agricultural Extension Service. In the absence of good information from these sources, a laboratory analysis must be performed.

Calculate the cumulative cadmium loading for each major soil type. Compare this loading to the levels established for the appropriate cation exchange capacity ranges in the Criterion. Do not average CEC over all the soil types.

Cumulative cadmium loading in kg/ha is determined as:

$$\left[\text{Soil Cd concentration } \left(\frac{\text{mg}}{\text{kg}}\right) - \text{Background Cd concentration } \left(\frac{\text{mg}}{\text{kg}}\right)\right]\cdot\left[\text{Soil density } \left(\frac{\text{kg}}{\text{m}^3}\right)\right]\cdot\left[\text{Depth of tillage (m)}\right]\cdot\left[10{,}000\ \frac{\text{m}^2}{\text{ha}}\right]\cdot\left[\frac{\text{kg}}{10^6\ \text{mg}}\right]$$

$$\left(\text{i.e., } \frac{\text{kg}}{\text{ha}} = a\ \frac{\text{mg}}{\text{kg}} \times b\ \frac{\text{kg}}{\text{m}^3} \times c\ \text{m} \times 0.01\right),$$

where a - c are site-specific values.

CHAPTER 7

APPLICATION TO LAND USED FOR THE PRODUCTION OF FOOD-CHAIN CROPS

Criterion Compliance Decision

☐ *Does Not Require Further Evaluation*

☐ *Does Not Comply*

1. Is solid waste applied to land used for the production of food-chain crops?

   ☐ YES (continue to 2)
   ☐ NO (*DOES NOT REQUIRE FURTHER EVALUATION)*
   ☐ The land is not used for the production of food-chain crops
   ☐ Facility is a surface impoundment

2. Is solid waste applied within one meter of the land surface?

   ☐ YES (continue to 3)
   ☐ NO (continue to 15)

3. Is the crop a food-chain crop other than only animal feed?

   ☐ YES [Evaluate against Criterion 257.3-5(a)(1) and corresponding Manual chapter, Section 3.2.1] (continue to 4)
   ☐ NO [Evaluate against Criterion 257.3-5(a)(2) and corresponding Manual chapter, Section 3.2.2] (continue to 11), or Criterion 257.3-5(a)(1).

4. Is the cadmium concentration in the waste less than 2 mg/kg (dry weight basis)?

   ☐ mg/kg - cadmium concentration ________________
   ☐ YES (continue to 6)
   ☐ NO (continue to 5)

5. Is the pH of the soil/waste mixture 6.5 or greater at the time of application?

   ☐ YES (continue to 6)
   ☐ NO (*DOES NOT COMPLY* - continue to 15)

CHAPTER 7

APPLICATION TO LAND USED FOR THE PRODUCTION OF FOOD-CHAIN CROPS

(continued)

6. Is waste applied to land used for the production of tobacco, leafy vegetables, or root crops grown for human consumption?

   ☐ YES (continue to 7)
   ☐ NO (continue to 8)

7. Is the cadmium loading rate less than 0.5 kg per ha per year?

   ☐ Annual cadmium loading rate ____________________

   ☐ YES (continue to 8)
   ☐ NO (*DOES NOT COMPLY* - continue to 15)

8. Where waste is being applied on land used for production of food-chain crops other than tobacco, leafy vegetables, or root crops for human consumption, does the annual cadmium application exceed:

Time Period	Annual cadmium rate (kg/ha)
☐ Present to 6/30/84	2.0
☐ 7/1/84 to 12/31/86	1.25
☐ Beginning 1/1/87	0.5

   ☐ YES (*DOES NOT COMPLY* - continue to 15)
   ☐ NO (continue to 9)

9. Determine the background soil pH

   ☐ Background soil pH ________________________

   ☐ If the value is greater than or equal to 6.5, proceed to 10.A. [See Section 3.2.1(f)(i)]
   ☐ If the value is less than 6.5, and the solid waste and soil mixture is adjusted to and maintained at 6.5 or greater whenever food-chain crops are grown, proceed to 10.A. [See Section 3.2.1(f)(ii)]
   ☐ If the value is less than 6.5, and the solid waste and soil mixture is not adjusted to 6.5 or greater, proceed to 10.B. [See Section 3.2.1(f)(i)]

CHAPTER 7

APPLICATION TO LAND USED FOR THE PRODUCTION OF FOOD-CHAIN CROPS

(continued)

10.A. Does the cumulative application of cadmium exceed the level indicated for the appropriate soil cation exchange capacity?

☐ Cumulative loading ______________

Soil CEC (meq/100 g)	Maximum Cumulative Amount (kg/ha)
☐<5	5
☐5-15	10
☐>15	20

☐ YES (*DOES NOT COMPLY* - continue to 15)
☐ NO (continue to 15)

B. Does the cumulative application of cadmium exceed the level indicated for the appropriate soil cation exchange capacity?

☐ Cumulative loading ______________

Soil CEC (meq/100 g)	Maximum Cumulative Amount (kg/ha)
☐<5	5
☐5-15	5
☐>15	5

☐ YES (*DOES NOT COMPLY* - continue to 15)
☐ NO (continue to 15)

11. Is the solid waste and soil mixture at pH 6.5 or greater at the time of solid waste application or at the time the crop is planted, whichever occurs later?

☐ YES (continue to 12)
☐ NO (*DOES NOT COMPLY* - continue to 15)

12. Is the pH of the solid waste/soil mixture maintained at 6.5 or greater whenever food-chain crops are grown?

☐ YES (continue to 13)
☐ NO (*DOES NOT COMPLY* - continue to 15)

CHAPTER 7

APPLICATION TO LAND USED FOR THE PRODUCTION OF FOOD-CHAIN CROPS

(continued)

13. Is there an operating plan which demonstrates how the crop is to be distributed to preclude ingestion by humans and provides safeguards to prevent possible health hazards resulting from alternative future uses of the land?

☐ YES (continue to 14)

☐ Crop distribution is controlled to prevent ingestion by humans

☐ Operating plan describes safeguards against possible entry of cadmium into food chain

Description ______________________________

☐ NO (*DOES NOT COMPLY* - continue to 15)

14. Does a notice appear in the land records notifying any future owners that the property has received solid waste at high cadmium application rates and that food-chain crops should not be grown, due to a possible health hazard?

☐ YES (continue to 15)

☐ NO (*DOES NOT COMPLY* - continue to 15)

15. Does the waste contain concentrations of PCBs equal to or greater than 10 mg/kg?

☐ YES (continue to 16)

☐ Analysis indicates 10 mg/kg or more. Value is __________

☐ NO (*DOES NOT REQUIRE FURTHER EVALUATION*)

☐ Analysis indicates less than 10 mg/kg

16. Is the waste incorporated into the soil of land used for producing animal feed, including pasture crops for animals raised for milk?

☐ YES (*DOES NOT REQUIRE FURTHER EVALUATION*)

☐ Waste is incorporated

☐ Land is used for other purposes

☐ NO (continue to 17)

17. Is the milk or animal feed monitored to assure that the PCBs concentration is less than 1.5 mg/kg (fat basis) in milk, or less than 0.2 mg/kg in animal feed?

    ☐ YES (*DOES NOT REQUIRE FURTHER EVALUATION*)

    ☐ NO (*DOES NOT COMPLY*)

    - ☐ Monitored levels are above those indicated
    - ☐ No monitoring, or inadequate monitoring is performed

CHAPTER 8

FLOODPLAINS

1.0 Criterion and Definitions

§ 257.3-1 Floodplains.

(a) Facilities or practices in floodplains shall not restrict the flow of the base flood, reduce the temporary water storage capacity of the floodplain, or result in washout of solid waste, so as to pose a hazard to human life, wildlife, or land or water resources.

(b) As used in this section:

(1) "Base flood" means a flood that has a 1 percent or greater chance of recurring in any year or a flood of a magnitude equalled or exceeded once in 100 years on the average over a significantly long period.

(2) "Floodplain" means the lowland and relatively flat areas adjoining inland and coastal waters, including flood-prone areas of offshore islands, which are inundated by the base flood.

(3) "Washout" means the carrying away of solid waste by waters of the base flood.

2.0 Inventory Procedure

The determination of facility non-compliance for the purposes of the Inventory consists of four parts:

(1) The elimination from further consideration of certain landspreading facilities which due to certain operational characteristics do not have a reasonable probability of posing a hazard;

(2) The elimination from further consideration of facilities which are not located in the floodplain;

(3) The determination of whether a hazard is posed due to restriction of flow and reduction of temporary water storage capacity (flood hazard assessment);

(4) The determination of whether a hazard is posed due to washout of the solid waste (washout hazard assessment).

For those facilities requiring a flood hazard assessment in part 3, a ranking procedure for establishing priorities is included. Figure 8-1 presents the decision flow chart.

2.1 Further Definitions

As used in this chapter:

(a) "Headwaters" means the point on a non-tidal stream above which the average annual flow is less than five cubic feet per second.[1]

3.0 Resolution of Decision Flow Chart Questions

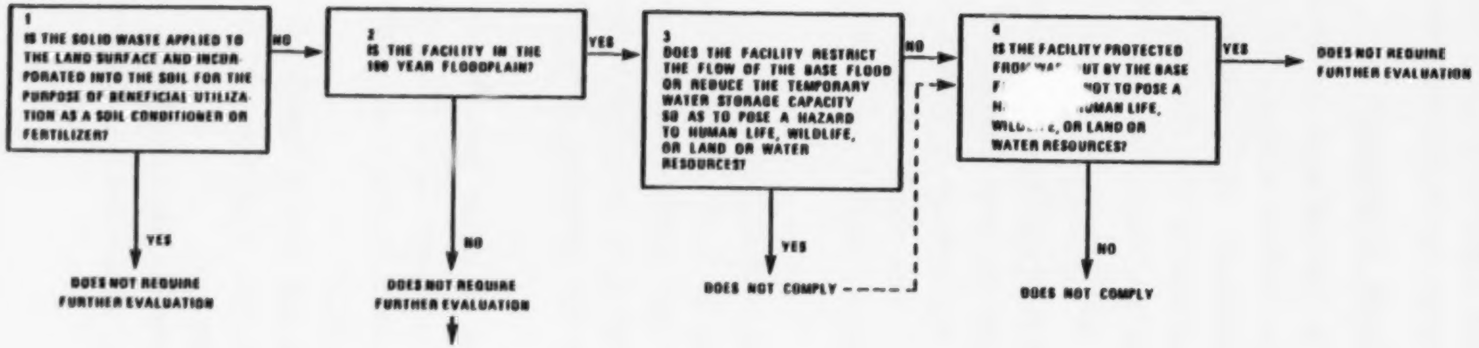
3.1 Is the solid waste applied to the land surface and incorporated into the soil for the purpose of beneficial utilization as a soil conditioner or fertilizer?

If landspreading of solid waste does not appreciably change the elevation of the natural land surface, the facility meets the flow restriction and temporary water storage requirements of the Criterion. At those facilities that incorporate the waste into the soil for the purpose of improving vegetative growth by utilization as a soil conditioner or fertilizer, it may be assumed that the erosion or washout potential is minimized by the enhanced vegetation. Therefore, for the purpose of the Inventory, *any landspreading facility that satisfies the following requirements need not be evaluated any further:*

(a) The waste is incorporated into the soil, in accordance with the requirements of the Criterion regarding application to land used for the production of food chain crops, at such a frequency that it is not subject to washout during flooding.

(b) The waste is used for a soil conditioner or fertilizer to improve vegetative growth.

(c) The waste disposal area is being used for vegetation at the time of the Inventory or will be during the next crop season.


1
IS THE SOLID WASTE APPLIED TO THE LAND SURFACE AND INCORPORATED INTO THE SOIL FOR THE PURPOSE OF BENEFICIAL UTILIZATION AS A SOIL CONDITIONER OR FERTILIZER?
NO
YES
DOES NOT REQUIRE FURTHER EVALUATION
2
IS THE FACILITY IN THE 100 YEAR FLOODPLAIN?
YES
NO
DOES NOT REQUIRE FURTHER EVALUATION
3
DOES THE FACILITY RESTRICT THE FLOW OF THE BASE FLOOD OR REDUCE THE TEMPORARY WATER STORAGE CAPACITY SO AS TO POSE A HAZARD TO HUMAN LIFE, WILDLIFE, OR LAND OR WATER RESOURCES?
NO
YES
DOES NOT COMPLY
4
IS THE FACILITY PROTECTED FROM [illegible] UT BY THE BASE F[illegible] NOT TO POSE A H[illegible] UMAN LIFE, WILD[illegible]E, OR LAND OR WATER RESOURCES?
YES
DOES NOT REQUIRE FURTHER EVALUATION
NO
DOES NOT COMPLY

NOTE: DASHED LINE INDICATES THE NEED TO CONTINUE TO THE NEXT FLOW CHART QUESTION

FIGURE 81 FLOWCHART – FLOODPLAINS

NOTE: A landspreading facility which does not satisfy the above requirements should be evaluated for a washout hazard.

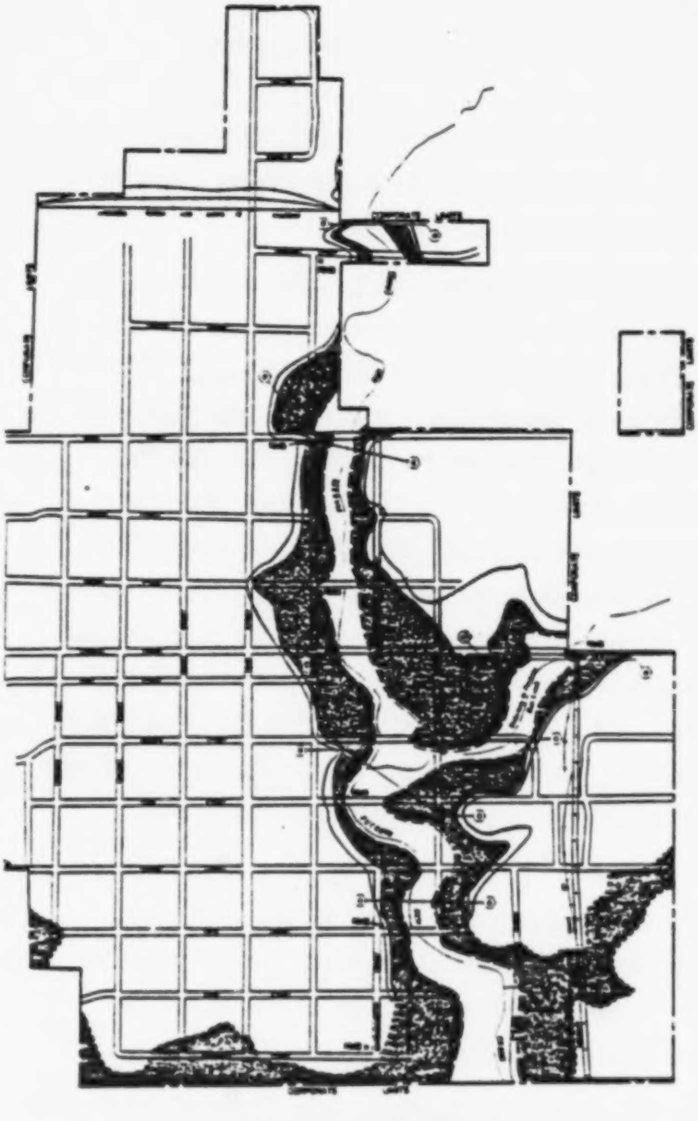
3.2 Is the facility located in the 100-year floodplain?

Checking the following situations in the sequence outlined is suggested as an initial step to determine whether a facility, or portion thereof, is located in the 100-year floodplain. It is necessary that the appropriate base and operating elevations of the facility be known in order to make this evaluation. Where the facility is not located in the 100-year floodplain, *no further evaluation is required.*

(a) Where existing permits or operation applications state that no portion of the facility is in the 100-year floodplain, as defined by the Criterion, and the application or permit is signed by a responsible official or party, then for the purposes of the Inventory, the State Solid Waste Agency should use this as the basis for evaluation.

(b) Existing 100-year floodplain maps should be used to determine whether any portion of the facility is in the 100-year floodplain, as defined by the Criterion. The most appropriate and recently prepared map should be used in areas that have been mapped several times. Maps and floodplain levels are generally available from the following sources.[2]

- State flood control agencies or other departments.
- Federal Emergency Management Agency (HUD) Flood Insurance Rate Map (FIRM) or Flood Hazard Boundary Map (FHBM) (an example is shown in Figure 8-2).
- Local and Regional Planning and Zoning Agencies.
- Soil Conservation Service - U.S. Department of Agriculture.
- U.S. Army Corps of Engineers.
- National Oceanic and Atmospheric Administration.
- Federal Housing Administration and Federal Insurance Administration.
- U.S. Geological Survey.
- Bureau of Land Management - Department of the Interior.



KEY TO MAP

500-Year Flood Boundary
100-Year Flood Boundary
FLOOD FRINGE
FLOODWAY
100-Year Flood Boundary
500-Year Flood Boundary
Approximate 100-Year Flood Boundary
Cross Section Line Ⓐ——Ⓐ
Elevation Reference Mark RM7
River Mile • M1.5

NOTES TO USER

Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations without regard to economic, legal, or political factors.

This map was prepared to support minimum flood plain management regulations; it may not show all areas subject to flooding in the community or all planimetric features outside special flood hazard areas.

For adjoining map panels, see separately printed Index to Map Panels.

ELEVATION REFERENCE MARKS

REFERENCE MARK	ELEVATION (FEET NGVD)	DESCRIPTION OF LOCATION
RM1	[illegible]	U.S. Geological Survey standard brass disk, stamped "...Erie 1934" set in top of concrete post flush with ground located in the city park, 4.7 feet north of the centerline of Third Street, 148 feet west of the centerline of Butler Street.
RM2	[illegible]	Top of southeastern bolt on the top flange of fire hydrant at northeast corner of the intersection of Fifth Street and Massachusetts Street.
RM3	[illegible]	Top of railroad spike projecting from north side of power pole, approximately one foot above the ground, located at northwest corner of intersection of Seventh Street and Massachusetts Street.
RM4	[illegible]	Top of west bolt on the top flange of fire hydrant at southeast corner of the intersection of Wilder Street and Butler Street.
RM5	[illegible]	Top of southeastern bolt on the top flange of fire hydrant at southeast corner of intersection of State Street and Butler Street.
RM6	[illegible]	Top of southeastern bolt on the top flange of fire hydrant at southeast corner of intersection of Railroad Street and Butler Street.
RM7	[illegible]	Chiseled cross on east end of south headwall of Second Street over the Tributary to [illegible] Run Creek.
RM8	[illegible]	Top of railroad spike head projecting from north side of power pole, approximately one foot above the ground, located at southeast corner of intersection of [illegible] Street and the Missouri, Kansas, Texas railroad tracks.

CITY OF
FLOODVILLE,
MICHIGAN

FIGURE 8-2 FLOOD BOUNDARY AND FLOODWAY MAP

Reproduced from best available copy.

- Bureau of Reclamation - Department of the Interior.
- Tennessee Valley Authority.
- River Basin Commissions and Special Flood Control Districts.
- Local and State agencies involved with public works construction, i.e., bridges, culverts, highways, channel improvements, and urbanization studies.

(c) Where a facility is located between two points at which the 100-year flood levels are known, a reasonable estimate of the flood level at the facility can be made by interpolating between the two known points based on the channel slope or the slope of the other known floods through the entire reach. The points might be selected from any combination of USGS gauge records, floodplain maps, historical records, or levels predicted for other uses such as bridge and highway design. This method should only be used where the entire floodplain between the two points and the facility is fairly straight and uniform with respect to dimension and roughness. If the floodplain is not uniform, this type of estimate should only be used as a quick indicator, unless the estimate can be verified with a conveyance calculation [3.2.1.2(c)].

(d) Approximate methods for quick prediction of the 100-year flood level may be used in situations where data exist for more frequent flood events. A method of this type is detailed in "Approximate Method for Quick Floodplain Mapping."[3]

(e) If all portions of the disposal facility are located such that the elevation difference from the facility to any nearby stream, river, or tidally influenced area is greater than the maximum recorded 100-year stage increase within the State or region, then the site may be considered not to be in the floodplain and *no further evaluation is required*. Information on maximum stage increases may be available from the sources listed in Section 3.2 (b) or from building code offices.

3.2.1 Estimating 100-year Flood Flow and Level

When none of the other determination methods apply, it may be necessary to make an estimate of the 100-year flood level at the facility location. An estimate of the level may not be necessary if the facility is located in a small drainage area (refer to Case 7, Section 3.3.1). This estimating requires experience and knowledge of floodplain hydraulics and flood flow determination. Frequently the first step will be to determine the flood flow at the facility location. The flood flow is then used to estimate the flood level. If the State Solid Waste Agency does not have experienced staff in this area, it is suggested that these estimates and some of the following determinations be made through consulting with one of the following:

- The State agency charged with flood protection or floodplain management.
- Any of the previously listed map source agencies.
- A qualified professional firm.

The following guidance is provided for estimating flood flow and level.

3.2.1.1 Guidance for Determining the 100-year Flood Flow at the Facility Location

Determination of flood levels frequently requires that the flood flow be known at the facility location. Listed in order of preference, the following methods or sources can be used to obtain the flood flow:

(a) Existing discharge probability analyses for the vicinity that may have been performed by State agencies or the USGS.

(b) The U.S. Soil Conservation PL 566 watershed plans.

(c) Flood hazard studies conducted for the Federal Flood Insurance Program.

(d) State Departments of Transportation or local public works offices, where there has been major construction in the vicinity.

(e) Procedures described in "Guidelines for Determining Flood Flow Frequency," Bulletin #17A, Water Resources Council, June 1977."

(f) Recently calibrated regional prediction methods; usually regression equations which are based on factors such as watershed areas and stream slopes. These are available for a number of States and are available from State water agencies or possibly as technical manuals produced by the USGS.

(g) Transfer methods based on ratios of drainage areas, provided there is similarity between the two drainage areas and their temporary storage characteristics.

(h) Interpolations between known flood flows from points upstream and downstream.

3.2.1.2 Guidance for Determining the 100-year Flood Level at the Facility Location

Once the flood flow is known at the location of the facility, a number of methods may be used to predict the flood level (disregarding any effects caused by the facility).

Suggested procedures are:

(a) Flood profile computational methods, such as the Corps of Engineers HEC-2 (a computer model for predicting flood profiles).[5]

(b) Step backwater analysis conducted through a series of cross-sections between two points of known flood levels, performed when downstream conditions might control the flood level at the facility location.

(c) Where downstream conditions do not affect the flood level at the facility, simple conveyance calculations or normal depth computations, such as with Mannings Equation, may be used at the facility cross-section only.

NOTE: Where possible, the constants used to predict the flood level by the above methods should be checked against a known historical event, or the flood level should be predicted using constants calibrated to a historical event.

Compare the estimated flood level with the elevation of the facility. If no portion of the facility is below the 100-year flood level, *then the facility need not be further evaluated.*

3.3 Does the facility restrict the flow of the base flood or reduce the temporary water storage capacity so as to pose a hazard to human life, wildlife, or land or water resources?

This determination, when conducted for a specific site, can be complex and costly and should only be made by a qualified professional. For purposes of the Inventory, the following sequential approach is suggested for evaluations:

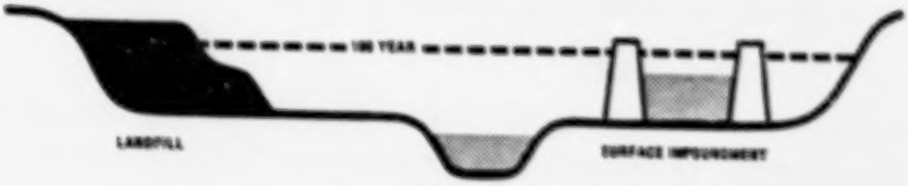
- Review several special cases to see if the facility fits one of these cases, thereby enabling a relatively simple determination.
- Rank the remaining facilities for assessment priority based on the flood hazard potential of the facility.
- Perform a flood hazard assessment (e.g., does the facility pose a hazard to human life, wildlife, or land or water resources).

3.3.1 Special Cases

Case 1 - If a facility is located in a State where the equivalent permit or review procedures have considered a facility's flood alteration impacts, and if it has been concluded that the facility does not pose a hazard to human life, wildlife, or land or water resources, *then the facility need only be further evaluated for the washout provision.* This includes facility siting decisions made in accordance with regulatory floodway adoption procedures of the National Flood Insurance Program. Assuming that such an assessment procedure exists at the State or local level, the question can be resolved by checking the records. It may be necessary to contact other State or local agencies involved in floodplain analysis.

Case 2 - If a facility has an individual permit for the discharge of dredged or fill material (Section 404, Clean Water Act) and the permit application included a flood hazard assessment equivalent to the assessment required in this section, and if the facility is in compliance with the permit conditions, *then the facility need only be further evaluated for the washout provision.* Either the Army Corps of Engineers or the State may have the 404 permit authority for a particular area. It will be necessary to consult with the Corps or the State 404 permit authority in order to determine if the flood hazard assessment is equivalent and to check on the facility's compliance with the permit. If the facility is not in compliance with its 404 permit, it may be necessary to make an assessment of the potential flood hazard.

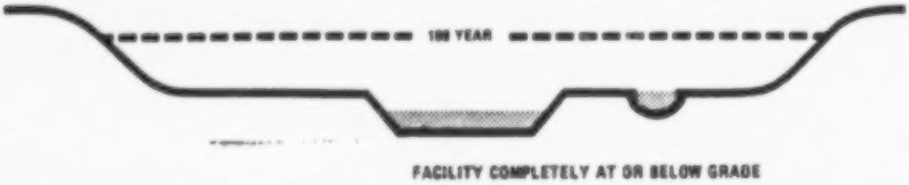
Case 3 - If a facility has completed filling of the floodplain area up to or above the 100-year flood level, or if it is completely diked to the 100-year flood level, then continued vertical expansion and operation will not further alter the base flood flow or storage capacity so as to pose any additional hazard. *Further evaluation is only necessary for the washout provision of the Criterion.*



SPECIAL CASE 3

Where current information on the level of the facility is available, the question can be resolved by comparing the level of the facility or dikes to the base flood height. If further horizontal expansion is planned, an assessment will have to be completed. Where no information on the level of the facility is available, site visits will be required. It may help to look for local information on past floods, as a facility inundated by a lesser flood will obviously be inundated by the base flood, and a facility that is above a flood of greater magnitude (such as a 500-year flood) will also be above the base flood. This information may be in the form of local records, personal testimony, or watermarks on structures or vegetation. Where information is not available or is questionable on the flood height, on-site surveying may be required.

Case 4 - If the level of the facility is below the natural land surface grade of the floodplain (e.g., in a pit or quarry), the facility will not restrict the flood flow and it is unlikely to significantly reduce the water storage capacity so as to pose a hazard, *therefore, it need not be further evaluated for this part of the Criterion.* The level of the facility is the top of the waste or dike, whichever is highest. If the mapped or predicted flood elevation was determined using the storage capacity or channel size provided by the pit or quarry, then this case does not apply. One obvious example might be a hillside excavation that increased the channel width and improved flow through the river reach, but was subsequently filled.

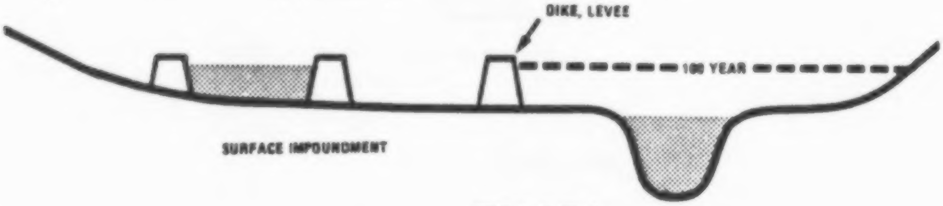


SPECIAL CASE 4

Where current information is available, this can be resolved in the office by referring to the records to determine the facility level relative to the land surface grade. Where the necessary information is not available or up to date, a site visit will be required. A visual check of the facility level should be sufficient. Where a more accurate determination is necessary, on-site surveying may be required. Another possibility would be the analysis of available aerial photography, if it is recent.

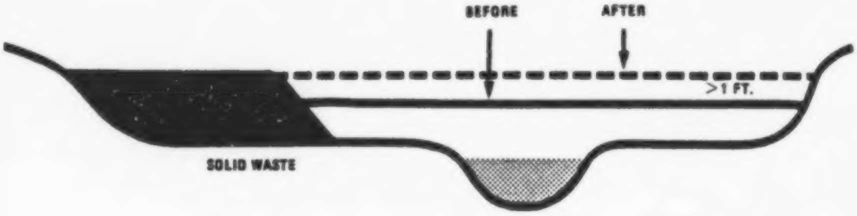
NOTE: All facilities in the 100-year floodplain must also protect against washout of solid waste. Since surface impoundments need dikes to protect from washout by the 100-year flood, they cannot be below grade and satisfy the Criterion requirements. On the other hand, landfills which are located in the floodway fringe and which are below grade might possibly meet the washout hazard requirements by covering the waste after each day's operation and protecting the surface as soon as each section (including intermediate levels) is completed. A landspreading facility which does not meet the requirements in Section 3.1 of this chapter will need to be evaluated for washout. If the facility uses dikes to protect from washout, then refer to Case 3.

Case 5 - If a facility is located in a floodplain where the stream, river, or tide is contained during the 100-year flood by a system of dikes, levees, berms, revetments, or other structures which were built for flood control purposes other than protection of the facility alone and such that the floodplain is no longer subject to flooding, *then the facility need not be evaluated further.*



SPECIAL CASE 5

Case 6 - If it can be determined by using any of the computational methods of Section 3.2.1.2 or equivalent procedures that the base flood level may be raised more than one foot (possibly less under some State or local flood control restrictions) by the location and operation of the facility, then for the purpose of the Inventory, *it may be assumed that the facility does pose a hazard and does not comply with this portion of the Criterion.* (The one-foot increase in the base flood level is the maximum increase allowed in the National Flood Insurance Program by FEMA, FR 10-26-76.)



SPECIAL CASE 6

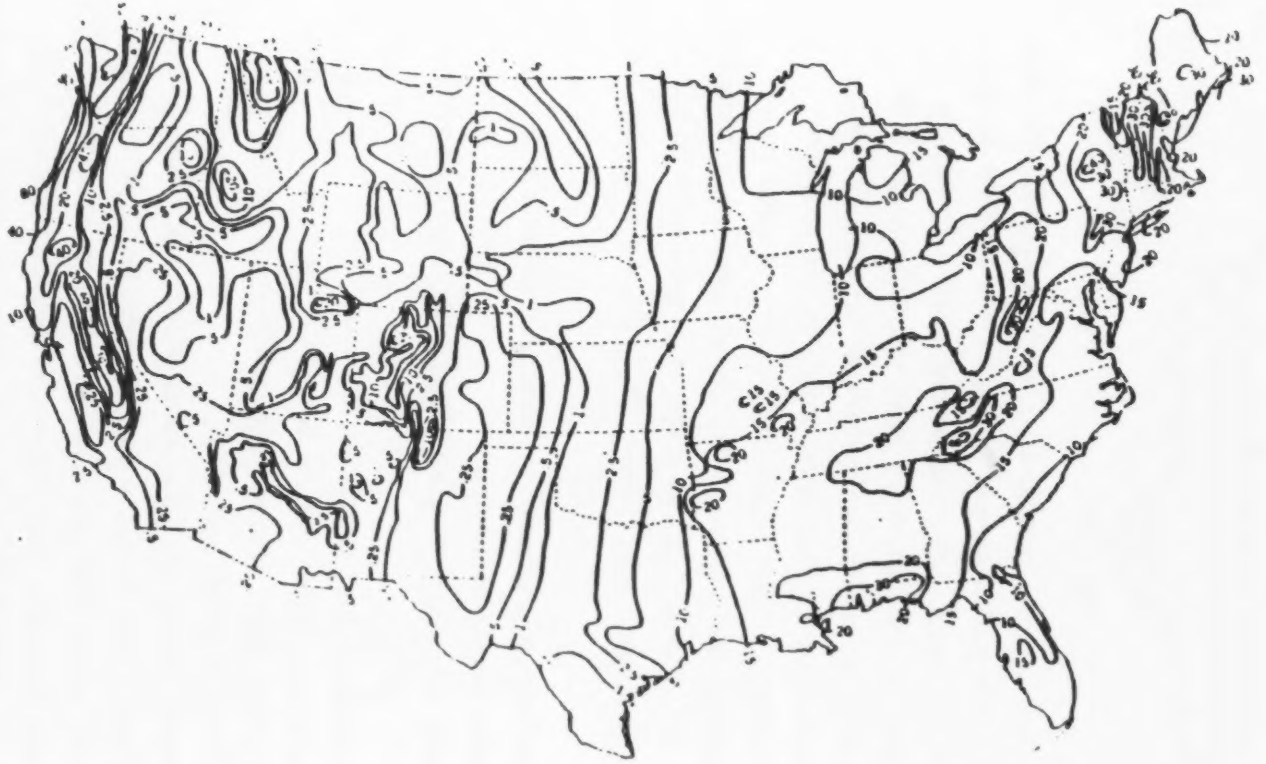
Case 7 - If the facility is located in a small unmapped drainage area at a point along a non-tidal stream at which the average annual flow is less than five (5) cubic feet per second (cfs), it may be presumed for the purpose of the Inventory that the effects of flow restriction and temporary water storage reduction are negligible. Therefore, further evaluation is only necessary for the washout provisions of the Criterion. This determination may be made by comparing the contributing drainage area to the stream at the location of the facility with the size of the drainage area necessary to yield a minimum of five cfs average annual flow. The following procedures may be used:

- Obtain the size of the contributing drainage area from a USGS 7½' or other topographic map.
- Compute the area necessary to yield the 5 cfs flow using the formula:

  43,560 ÷ average annual runoff in inches

  The "average annual runoff" may be derived from Figure 8-3 or from accurate State maps, perhaps available from the water resources or flood control agencies.
- Compare the contributing drainage area with the acreage derived from the equation. The facility may be considered to be above the "headwaters" where the contributing drainage area is less than the acreage derived. Note that the facility must still be evaluated for washout even if it is above the "headwaters."

In certain arid areas in the western portion of the country, this might not be applicable because of highly irregular flows. Check with the District Office of Corps of Engineers to determine whether this



10
20
30
40
5
2.5
1
10
15
20
10
15
20
10
15
20
30
15
10

FIGURE 8-3 NORMAL ANNUAL RUNOFF IN THE UNITED STATES, IN INCHES. (U.S. GEOLOGICAL SURVEY)

method is applicable or whether a "median" runoff rather than "average" runoff should be used.

3.3.2 Ranking of Facilities Not Covered by the Special Cases

Any facility located in the 100-year floodplain restricts the flow of the base flood or reduces the temporary water storage capacity of the floodplain to some degree. Therefore, the question is whether the reduction or restriction "poses a hazard to human life, wildlife, or land or water resources." The procedures discussed here are intended to provide guidance for the best possible resolution of the question.

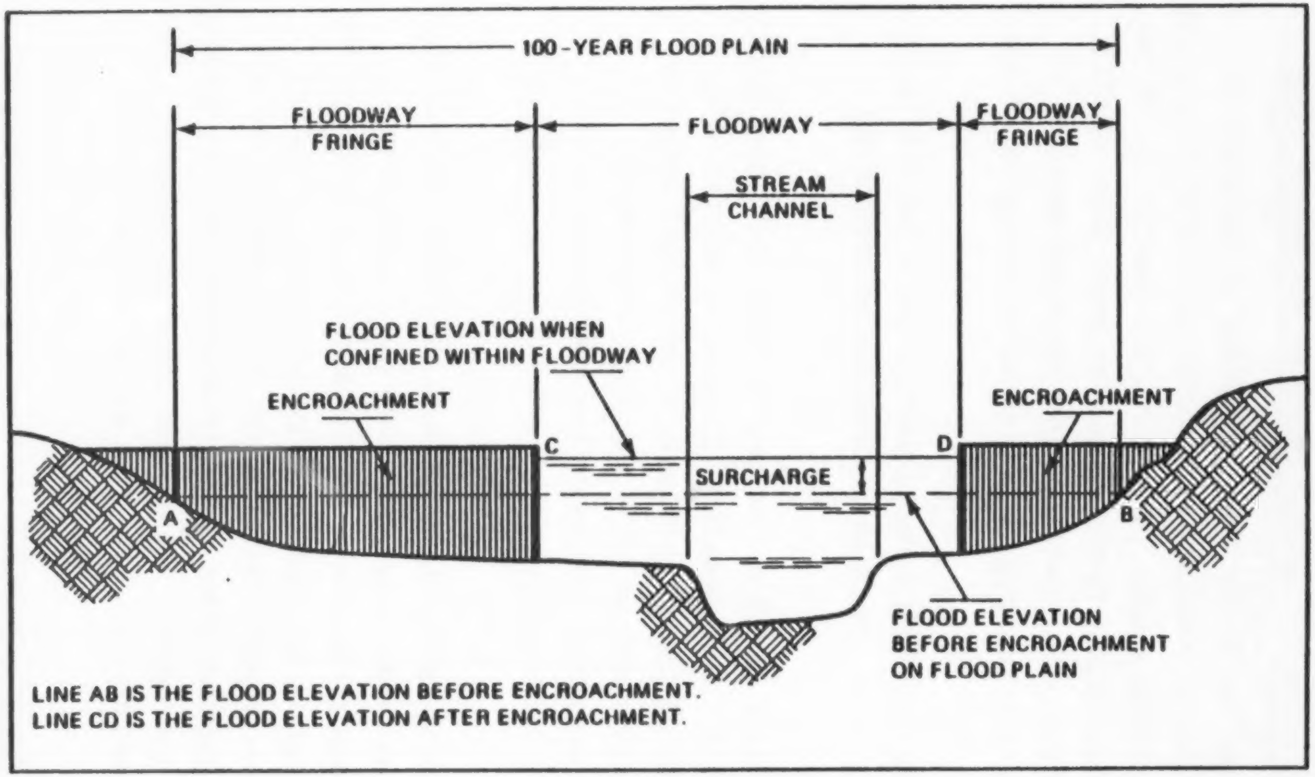
Since assessing the flood hazard potential for a facility can be complex and costly, it is advisable to establish priorities for evaluation.

(a) First priority should be assigned to those facilities within the boundaries of (1) a regulatory floodway as adopted under the National Flood Insurance Program of the Federal Emergency Management Agency, HUD, or (2) a regulatory floodway or equivalent as mapped by a State or local government or other organization. Refer to Figures 8-2 and 8-4 for the floodway delineation.

(b) The remaining floodplain facilities, including those located in coastal high hazard areas, should be given priorities according to their relative flood hazard potential as determined by their floodplain and facility characteristics. Table 8-1 shows how these characteristics affect flood hazard potential. Since these characteristics are so interrelated and site specific, they are not quantified. The greater the hazard potential, the higher the assessment priority that should be given to the facility.

3.3.3 Flood Hazard Assessment

Once prioritization is completed, an assessment of the flood hazard must be made in order to resolve the Criterion question.


100-YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE
A
B
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN

LINE AB IS THE FLOOD ELEVATION BEFORE ENCROACHMENT.
LINE CD IS THE FLOOD ELEVATION AFTER ENCROACHMENT.

FIGURE 8-4 DIAGRAM OF THE 100 YEAR FLOODPLAIN

TABLE 8-1

FLOOD HAZARD RANKING

Floodplain Characteristics	Increasing Flood Hazard Potential → Low	High
(1) Location in the floodplain	flood fringe	floodway
(2) Size of watershed	small	large
(3) Shape of the floodplain	broad, shallow	narrow, v-shaped
(4) Percentage of the floodplain cross-section area occupied by the facility	small percent	large percent
(5) Volume of facility (acreage and depth)	small	large
(6) Flood flow velocity	low velocity	high velocity

However, as recognized by EPA in the preamble to the Criteria, the issue as to what constitutes a flood hazard cannot be specified for all situations and must therefore be decided on a case-by-case basis. In lieu of this, the following section contains guidelines on how to approach the assessment without describing a flood hazard assessment procedure.

The following factors should be considered:

(a) base flood characteristics
  - flow
  - velocity
  - level
  - cross-sectional areas of the floodplain

(b) floodplain topography

(c) facility characteristics
  - type (e.g., landfills, surface impoundments, landspreading)
  - size (cross-sectional area of channel occupied by facility; volume - acreage and depth)
  - location in the floodplain (e.g., floodway or floodway fringe)
  - impacts on flooding (e.g., restricts flood flow)

(d) natural resources in and adjacent to the floodplain (i.e., wetlands, timber resources, soil, wildlife habitat, etc.)

(e) land use in and adjacent to the floodplain

The flood hazard assessment can be made in-house if the professional expertise is available. Where the necessary expertise is not available, technical assistance should be solicited from the State agency charged with flood protection or floodplain management. Frequently the agency can make this decision quickly based on accumulated information on the river reach in question and maximum allowable stage increases on the river. If the State agencies are not in a position to provide the necessary technical assistance, there are several Federal agencies that may be consulted.

- Soil Conservation Service (USDA) - provides technical assistance in determining flood hazards, mainly through the Floodplain Management Assistance Program.
- Army Corps of Engineers - provides interpretation of floodplain data, develops new data, and provides guidance on assessing and minimizing flood hazards through the Floodplain Management Services Program.
- National Oceanic and Atmospheric Administration (USDC) - provides floodplain information and interpretive assistance for specific points on larger rivers.
- Federal Emergency Management Agency (HUD) - conducts flood hazard studies (Flood Insurance Study Reports) for selected areas, also maintains a listing of qualified consulting engineers.
- U.S. Geological Survey (USDI) - User Assistance Centers provide information on flood characteristics, provides interpretive information on flood frequency relationships, and identifies area of potential flood hazard.
- Bureau of Reclamation (USDI) - flood hydrologists at regional offices can provide flooding information and interpretive assistance for locations associated with Bureau projects.
- Fish and Wildlife Service (USDI) - provides expertise on wildlife and habitat resources, preservation, and maintenance.
- Tennessee Valley Authority - provides technical assistance and flood data for the Tennessee Valley Watershed.
- Delaware River Basin Commission - provides interpretive assistance and flood data for the Delaware basin.
- Susquehanna River Basin Commission - provides general information and guidance on floodplain management.
- Additional sources of assistance and information are other river basin commissions, flood control districts, and regional and local planning agencies.

Where insufficient assistance is available from governmental agencies, the services of a qualified professional should be obtained.

When the flood hazard assessment concludes that the facility poses a hazard, *it does not comply with the Criterion.* All facilities located in the floodplain, complying or not, must still be evaluated for their washout hazard.

3.4 Is the facility protected from washout by the base flood so as not to pose a hazard to human life, wildlife, or land or water resources?

The Criterion objective is to prevent solid waste from being carried away by waters of the base flood. Therefore, to comply with this part of the Criterion, a facility must prevent washout by the base flood. A facility protected against inundation is not necessarily protected against washout of the waste. A facility can be inundated without washing out, and washed out without being inundated. The former occurs when waste is covered or held by vegetated soil, and the base flood inundates the surface but does not erode and wash out waste. The latter can occur when the facility is diked or the waste covered up to the 100-year level, if the dike or covering is insufficient.

3.4.1 Special Cases

Three cases may be readily resolved without requiring a washout hazard assessment.

Case 1 - If a facility has a 404 permit, or is located in a State where the equivalent permit, inspection, or review procedures require the facility to be protected from washout by the base flood, and if the State or 404 permit process has determined that the facility is adequately protected, *then the facility need not be further evaluated.* The question is resolved by checking the records of the facility.

Case 2 - If a facility has suffered from washout by floods of lesser magnitude (such as a 10-year event) than the base flood, then it can be concluded that the facility will also wash out in the base flood, and *therefore does not comply with this portion of the Criterion*. Determination of washout by lesser floods can be made by referring to past inspection records or by a field check of the site for visible evidence of washout. Erosion due to surface runoff should not be considered evidence of washout due to flooding.

Case 3 - If the waste deposit below flood level is routinely left directly exposed to potential flooding for extended periods of time, it may be presumed that the waste will washout during a base flood and *therefore the facility does not comply with this portion of the Criterion*. Examples are:

- Landfills that do not apply periodic cover material.
- Surface impoundments with dike heights less than the base flood level.
- Landspreading sites that do not routinely incorporate the waste.

3.4.2 Washout Hazard Assessment

In situations where the special cases were not applicable, an evaluation of the washout protection will be necessary. This can be done on an in-house basis, in consultation with another State agency, or through the services of a consultant. Also, the Soil Conservation Service, USDA, might provide technical assistance in analyzing erosion and washout protection methods. Other Federal agencies, such as the U.S. Geological Survey and Army Corps of Engineers, might also assist with such an evaluation.

Information needed for assessment of a facility's washout hazard potential includes:

(1) types of washout protection used in each area of the facility below the 100-year flood level, such as:

- soil type (cover or dike)
- vegetation (quality of stand)
- riprap, asphalt, stabilized soil

(2) flood flow velocity; using a flood flow velocity of 2.5 times the average velocity over the entire floodplain cross-section for those portions of the facility in the floodway and a value of 1.0 times the average velocity over the entire floodplain cross-section for those portions of the facility in the floodway fringe.

That is: $\bar{v} = Q/A$

where $\bar{v}$ = average velocity

Q = 100-year flood flow (cfs)

A = cross-sectional area of floodplain to 100-year flood level

To compute the average velocity, the flood flow at the facility may be obtained using any of the methods listed in Section 3.2.1. The cross-sectioned area may be measured in the field, obtained from recent topographic maps, or obtained from the facility permit maps.

Using the appropriate multiplier (2.5 or 1.0) times the average velocity, compare that estimated velocity with the permissible velocities for soil and vegetative protection in Tables 8-2 and 8-3. If the estimated flood flow velocity is greater than the permissible velocity (washout), the waste may be presumed to be washed out during the base flood and *the facility does not comply with this portion of the Criterion*. Reference 6 may be consulted for protection methods other than grass and vegetation.

TABLE 8-2

ERODIBLE VELOCITIES FOR SOILS

Material	Clear Water (fps)	Water Transporting Silts (fps)
Fine sand, colloidal	1.50	2.50
Sandy loam, non-colloidal	1.75	2.50
Silt loam, non-colloidal	2.00	3.00
Alluvial silts, non-colloidal	2.00	3.50
Ordinary firm loam	2.50	3.50
Volcanic ash	2.50	3.50
Stiff clay, very colloidal	3.75	5.00
Alluvial silts, colloidal	3.75	5.00
Shales and hardpans	6.00	6.00
Fine gravel	2.50	5.00
Graded loam to cobbles when non-colloidal	3.75	5.00
Graded silts to cobbles when colloidal	4.00	5.50
Coarse gravel, non-colloidal	4.00	6.00
Cobbles and shingles	5.00	5.50

Source: Chow, V.T., Open Channel Hydraulics, McGraw-Hill, New York 1959.

TABLE 8-3

ERODIBLE VELOCITIES FOR VEGETATION

Vegetative Cover Type	Permissible Velocity (fps)	
	Erosion-Resistant Soils	Easily Eroded Soils
Bermuda grass	6-8	4-6
Buffalo grass, Kentucky bluegrass, smooth brome, blue grama	5-7	3-5
Grass mixture	4-5	3-4
Lespedeza sericea, weeping love grass, ischaemum (yellow bluestem), kudzu, alfalfa, crabgrass	3.5	2.5
Annuals - used on mild slopes or as temporary protection until permanent covers are established, common lespedeza, Sudan grass	3.5	2.5

Source: Chow, V.T., Open Channel Hydraulics, McGraw-Hill, New York 1959.

4.0 References

1. Title 33, Navigation and Navigable Waters, Chapter II, U.S. Army Corps of Engineers, July 1977.

2. "Floodplain Management Guidelines." U.S. Water Resources Council 43 FR 6030, February 10, 1978.

3. Powell, Roy F., L. Douglas James, and D. Earl Jones, Jr. "Approximate Method for Quick Floodplain Mapping." Journal of the Water Resources Planning and Management Division, ASCE, Vol. 106, No. WR1, Proc. paper 15243, March 1980. pp. 103-122.

4. "Guidelines for Determining Flood Flow Frequency." Bulletin No. 17A, United States Water Resources Council, 2120 L Street, N.W., Washington, D.C. 20037, Revised, June 1977.

5. "HEC-2." The Hydrologic Engineering Center, U.S. Army Corps of Engineers, Davis, California, November 1976.

6. "Shore Protection Manual." U.S. Army Coastal Engineering Research Center, Department of the Army, Corps of Engineers, 1975. USGPO, Stock #008-022-0007-1, 3 volumes.

CHAPTER 8

FLOODPLAINS

Criterion Compliance Decision

☐ *Does Not Require Further Evaluation*

☐ *Does Not Comply*

1. Is the solid waste applied to the land surface and incorporated into the soil for the purpose of beneficial utilization as a soil conditioner or fertilizer?

☐ YES - Satisfies all three requirements (*DOES NOT REQUIRE FURTHER EVALUATION*)

- ☐ Waste incorporated into the soil in accordance with requirements of Section 257.3-5
- ☐ Waste used as a soil conditioner or fertilizer
- ☐ Disposal area being used (or will be used next crop season) for vegetation

☐ NO (continue to 2)

2. Is the facility located in the 100-year floodplain?

- ☐ (a) Stated in permit or operation applications
- ☐ (b) Comparison to existing floodplain map: mapping agency ____________________
- ☐ (c) Interpolation between two known points of the 100-year flood level
- ☐ (d) Quick approximation of 100-year flood level
- ☐ (e) Comparison of site elevation with 100-year stage increase
- ☐ (f) Computation of flood flow: Method used ____________________
- ☐ (g) Computation of flood level: Method used ____________________

☐ YES (continue to 3)

☐ NO (*DOES NOT REQUIRE FURTHER EVALUATION*)

3. Does the facility restrict the flow of the base flood or reduce the temporary water storage capacity so as to pose a hazard to human life, wildlife, or land or water resources?

A. Special Cases (where not applicable, continue to 3B):

☐ NO (continue to 4)

- ☐ Facility located in a State where equivalent review or permit procedures have concluded flood alteration impacts do not pose a hazard
- ☐ Facility has a 404 permit with an equivalent flood hazard assessment section and is in compliance with the permit

CHAPTER 8

FLOODPLAINS

(continued)

- ☐ Facility has completely filled or is diked up to or above 100-year level and is no longer expanding horizontally
- ☐ Facility is below floodplain grade
- ☐ Facility located in a floodplain where the channel is diked to contain the base flood
- ☐ Headwaters area of less than 5 cfs average annual flow
- ☐ Facility does not cause an increase in flood level greater than 1.0 feet (or maximum allowable State level)

☐ YES (*DOES NOT COMPLY* - continue to 4)

- ☐ Facility causes greater than 1.0 foot increase (or maximum allowable State level) in flood level

B. Assessment (where special cases are not applicable):

Priority of facility:

- ☐ Regulatory floodway area - priority 1
- ☐ High flood hazard potential area (Table 8-1) - priority 2
- ☐ Low flood hazard potential area (Table 8-1) - priority 3

Factors considered in flood hazard potential assessment:

- ☐ Base flood characteristics: ____________________
- ☐ Floodplain topography: ____________________
- ☐ Floodplain hydrogeology: ____________________
- ☐ Facility characteristics: ____________________
- ☐ Natural resources in and adjacent to the floodplain: ______ ____________________
- ☐ Land use in and adjacent to the floodplain: ____________

☐ YES (*DOES NOT COMPLY* - continue to 4)

☐ NO (continue to 4)

4. Is the facility protected from washout by the base flood so as not to pose a hazard to human life, wildlife, or land or water resources?

Special Cases (where applicable):

☐ YES (*DOES NOT REQUIRE FURTHER EVALUATION*)

- ☐ State washout assessment in permit, inspection, or review procedures determined adequate protection
- ☐ Individual 404 permit which assessed washout

☐ NO (*DOES NOT COMPLY*)

- ☐ Known to wash out from floods of lesser magnitude than the 100-year flood
- ☐ Wastes unprotected from washout

Assessment (where special cases are not applicable):

The facility is located in floodplain, where the estimated flood flow velocity:

☐ In the floodway is 2.5 times average flood flow velocity ____________

☐ In the floodway fringe is 1.0 times average flood flow velocity ____________

Types of cover and velocities at which they wash out

☐ Soil ____________
☐ Grass ____________
☐ Riprap ____________
☐ Dike or levee ____________
☐ Other ____________
☐ None ____________

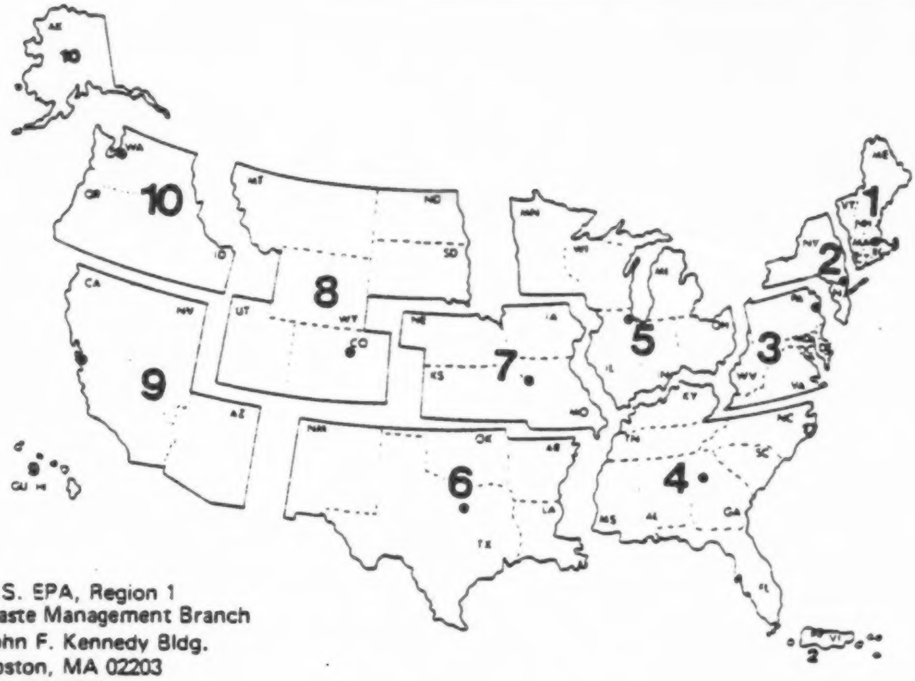
☐ YES (*DOES NOT REQUIRE FURTHER EVALUATION*)

☐ Estimated flood flow velocity is less than the erodible (washout) velocity

☐ NO (*DOES NOT COMPLY*)

☐ Estimated flood flow velocity is greater than or equal to the erodible (washout) velocity

EPA REGIONS



U.S. EPA, Region 1
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John F. Kennedy Bldg.
Boston, MA 02203
617-223-5775

U.S. EPA, Region 2
Solid Waste Branch
26 Federal Plaza
New York, NY 10007
212-264-0503

U.S. EPA, Region 3
Hazardous Materials Branch
6th and Walnut Sts.
Philadelphia, PA 19106
215-597-7370

U.S. EPA, Region 4
Residuals Management Br.
345 Courtland St., N.E.
Altanta, GA 30365
404-881-3016

U.S. EPA, Region 5
Waste Management Branch
230 South Dearborn St.
Chicago, IL 60604
312-353-2197

U.S. EPA, Region 6
Solid Waste Branch
1201 Elm St.
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U.S. EPA, Region 9
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